"INDUSTRY."

A MAGAZINE

Devoted to Science, Engineering, and the Mechanic Arts, Especially on the Pacific Coast.

JANUARY TO DECEMBER, 1895.

(INCLUSIVE)

INDUSTRIAL PUBLISHING COMPANY
40 CALIFORNIA STREET
SAN FRANCISCO.

No. 78. JANUARY, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

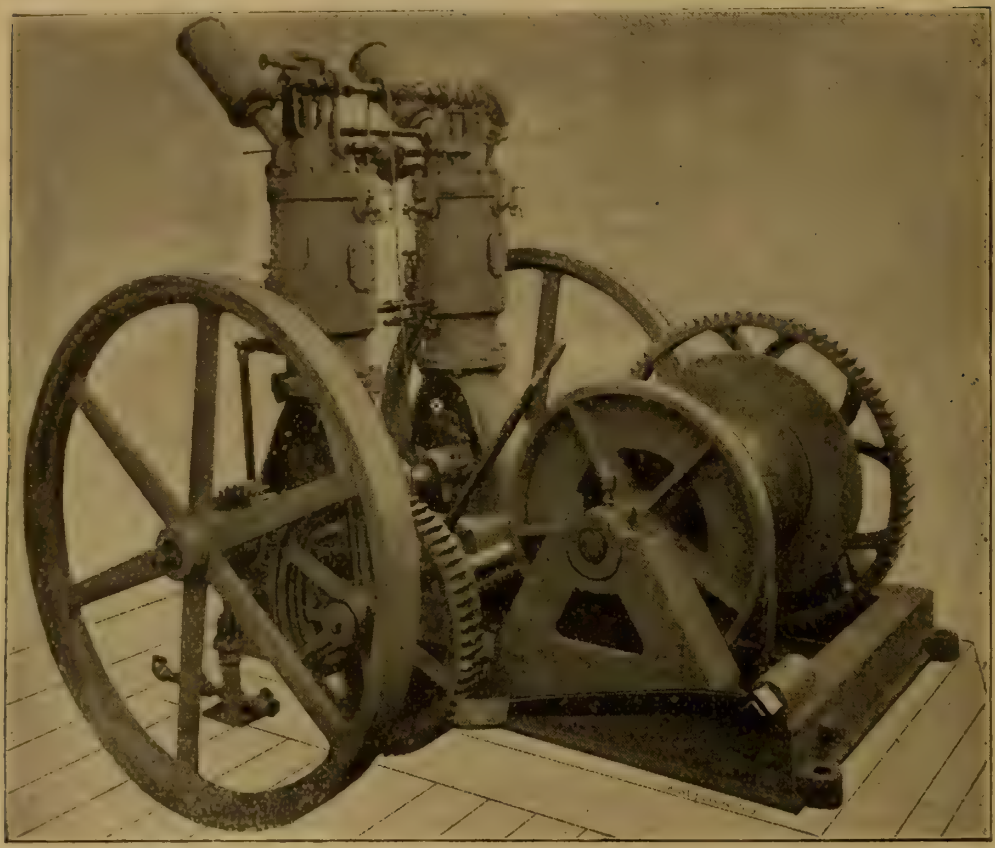
JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.



The "Golden Gate" Gas Engine

is not a new comer, but has not been advertised in the papers as some others, but if you are in need of a Gas Engine, just ask anyone who ever had anything to do with them, and they will tell you:

"Get the Golden Gate."

Uses Gas or Gasoline.

Made and Sold by

ADAM SCHILLING & SONS

211-213 Main Street, San Francisco.

The "GOLDEN GATE" is made strictly according to its own Letters Patent issued.

FRANCIS SMITH & CO.

SHEET IRON & STEEL PIPE

130 BEALE STREET, SAN FRANCISCO

☞ Iron cut, punched and formed, for making pipe on ground where required. All kinds of Tools for making Pipe. Estimates given when required. Are prepared for coating all sizes of pipes with a composition of asphaltum.

SMITH & YOUNG

BUILDING SUPPLIES

230½ South Spring St., Los Angeles, Cal. — **723 Market St., S. F., Cal.**

Specialties.—Blue Print Paper; Casing Blocks; Deadening Felt; Infusorial Earth; Lamps, Buckeye Incandescent; Bostwick Steel Lathe; Marble; Mineral Wood; Mouldings, Turned Art; Paints, Plumbago and Malthine; Pecora Mortar Stains; Roofing; Sheathing Papers; Sash Balance and Lock, Combined; Shingle Stains; Soapstone; Spiral Balusters; Wood Carvings and Ornaments.

BY MAIL, 25 CENTS

THE GERMAN ROTE LEXICON

(SECOND EDITION)

German Translation Learned in One Month

An entirely new method. Commended by scholars and teachers. Assists but does not interfere with the regular course of study. 1,500 root words with prefixes and suffixes, prepositions, adverbs, conjunctions, declensions of articles and pronouns.

CENTRIFUGAL PUMPS

Construction, Operation, History and Examples.

BY JOHN RICHARDS.

TWENTY-THREE ILLUSTRTAIONS.

In Cloth Binding, postpaid $1.00

INDUSTRIAL PUBLISHING CO.

40 California St., San Francisco.

"INDUSTRY."

JOHN RICHARDS, Editor.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

San Francisco.

Founded 1888. JANUARY, 1895. No. 78

CONSTRUCTIVE ENGINEERING ON THE PACIFIC COAST.

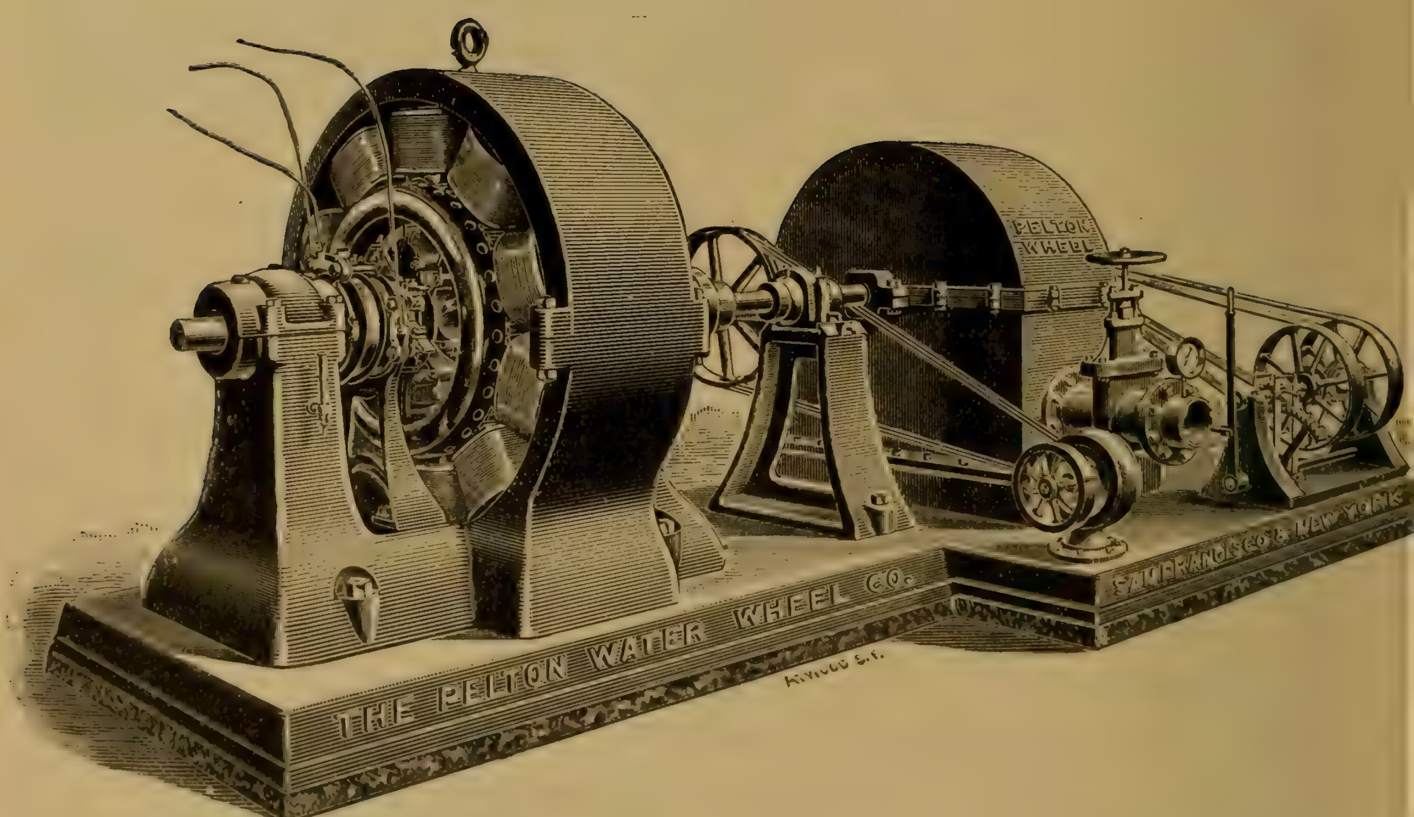
No. II.

WATER POWER ON THE PACIFIC COAST.

The history of turbine wheels in the United States is a strange one. Forty years ago, and soon after the theory of such turbine wheels was laid down by eminent engineers in France, Fourneyron wheels of the highest class were introduced in this country by Boyden & Francis. They were made in strict accordance with hydrodynamic laws in the most perfect manner, and even improved over the plans of M. Fourneyron by the addition of "diffusers," invented by Boyden, and applied to a number of wheels at Lowell, Mass.

The writer had the privilege of examining some of these wheels in 1857, then in construction at the Lowell Machine Company's works. The vanes were of steel, scoured or polished, and sharpened at their edges like a knife. The duty and efficiency of these wheels is a matter of history. They stand now among the best examples in this country, or in the world, but were expensive to construct, and called for implements not available in small or average shops.

The Jonval wheel, with a straight through flow, parallel to the axis of rotation, soon followed in this country, introduced by



Constructive Engineering on the Pacific Coast.

TANGENTIAL WATER WHEEL AND MOTOR.

THE PELTON WATER WHEEL COMPANY, SAN FRANCISCO.

Diameter of the water wheel, 7 feet.— Diameter of nozzle, 4 inches.— 735 horse power.— Differential governor.— In use at the Treadwell Mine, Douglas Island, Alaska.

M. Geyelin, of Philadelphia, but these too were expensive to construct, and the manufacture has not spread much for common uses. Some fine examples have recently been erected at Niagara Falls.

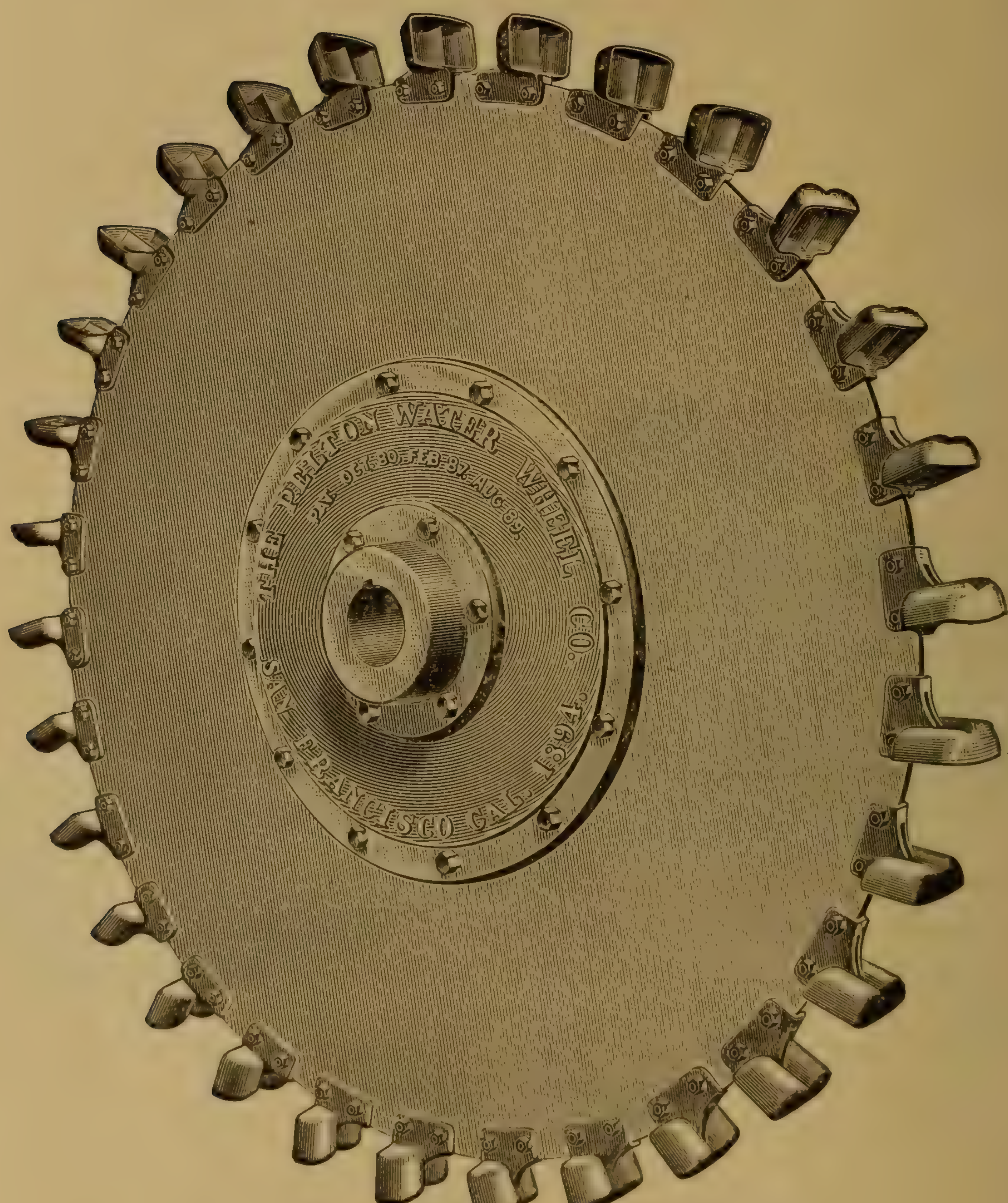
Previous to this time, about 1850, the experiments of Thompson and Whitelaw, at Glasgow, with inward discharge turbines, attracted attention in this country, and American makers began the development of wheels of this class that form an important part of turbine history. The wheels are cheap, because of the small diameter permitted by inward discharge. The speed is greater, and the wheels are cast whole, in one piece. The efficiency attained by the best-made wheels of this type is claimed to equal that of the more refined French turbines. They are less impeded by drift wood, do better in foul water, and do not cost more than half as much as the Fourneyron or Jonval wheels of like power.

This American type spread all over the Eastern country, but no attention then, or even now, has been given to the open or impulse turbines invented by Girard about 1860. The tenders for wheels at Niagara Falls, in 1892, where no American turbine was considered, was almost the first thing to apprize the people of the Atlantic States that there was such a thing as impulse wheels adapted to high heads. As remarked, no plans from this country were considered by the Niagara Commission in London, except those furnished by the Pelton Water Wheel Company, of this City, who received a premium and award for their tangential wheels.

The reason for this neglect of Girard wheels, that had taken a foremost place in Europe, is accountable for mainly by the requirements in the Eastern States. There are seldom high heads to deal with, almost never, one may say, because from the eastern base of the Rocky Mountains to the Atlantic Coast there are no mountains, except the Appalachian chain, no snow-fed mountain streams, and no heads to require open or impulse wheels.

This brings us to the Pacific Coast, where without knowledge of the principles laid down by Girard and others, impulse or tangential wheels were invented in various forms, from the crude flat vanes at first employed, up to wheels of refined construction, 8 feet in diameter, to exert 700 horse power, and others to operate under heads of 2,000 feet.

This development of impulse or tangential wheels on the Pacific Coast, the hundreds of special applications to all purposes requiring power under high heads, as before said, without aid or suggestion from makers in Europe, and in advance of any practice of the kind



Constructive Engineering on the Pacific Coast.

WATER WHEEL FOR A HEAD OF 2100 FEET.

PELTON WATER WHEEL COMPANY, SAN FRANCISCO.

Pressure 911 pounds per inch.—Wheel 36 inches diameter, to run at 1,150 revolutions per minute.—Velocity of rim per minute, 10,804 feet, or 120 miles an hour.—Web is of plate-steel; buckets of phosphor bronze.

in the Eastern States, is a remarkable and creditable feature of constructive engineering on this Coast.

There is not much that is typical or standard in this practice, and as various examples have been illustrated, from time to time, in this Journal, we present here only two plates, showing practice by the Pelton Water Wheel Company, of San Francisco. These tangential wheels have been sent from here all over the world, and a branch of the company named is maintained in New York.

ELECTRIC MACHINERY ON THE PACIFIC COAST.

It will be a surprise to people in the Eastern States, and also to a good many on this Coast, to know that there is carried on in San Francisco the construction of generators, motors, and other kinds of electrical apparatus of a high class. We allude to the Electrical Engineering Company, that have introduced a good many novel features in this kind of machinery, and have executed a number of important contracts for transmitting and other plants.

The plates selected are in two cases from recently-erected machines for mining purposes, and exhibit in design, practice of the best kind, and fully abreast with that in any part of the world. We are not able to describe technically the features that distinguish the machinery and apparatus made at these works, but may point out the method of regulating motors by inertia.

The regulation of electric motors by centrifugal apparatus that has to assume gradually a new position by increased or diminished speed has not succeeded well. The inertia system does not call for such change of position. It is fast becoming adopted for steam-engine regulation, and it is but natural that the same method should be applied to electric motors. To explain this system in general terms, it consists in deriving the strain and movement required for regulation from the direct power of the motor instead of centrifugal force.

This method of regulation, which was described in the last number of "INDUSTRY,"* in so far as its application to steam engines, should be credited to this Coast. The application to electric motors is, however, a distinct method, or, as may be said, is a third stage of the invention. The first was by Sergeant, in 1858; secondly, by Dr. Werner Siemens about ten years ago, and the third by Meston,

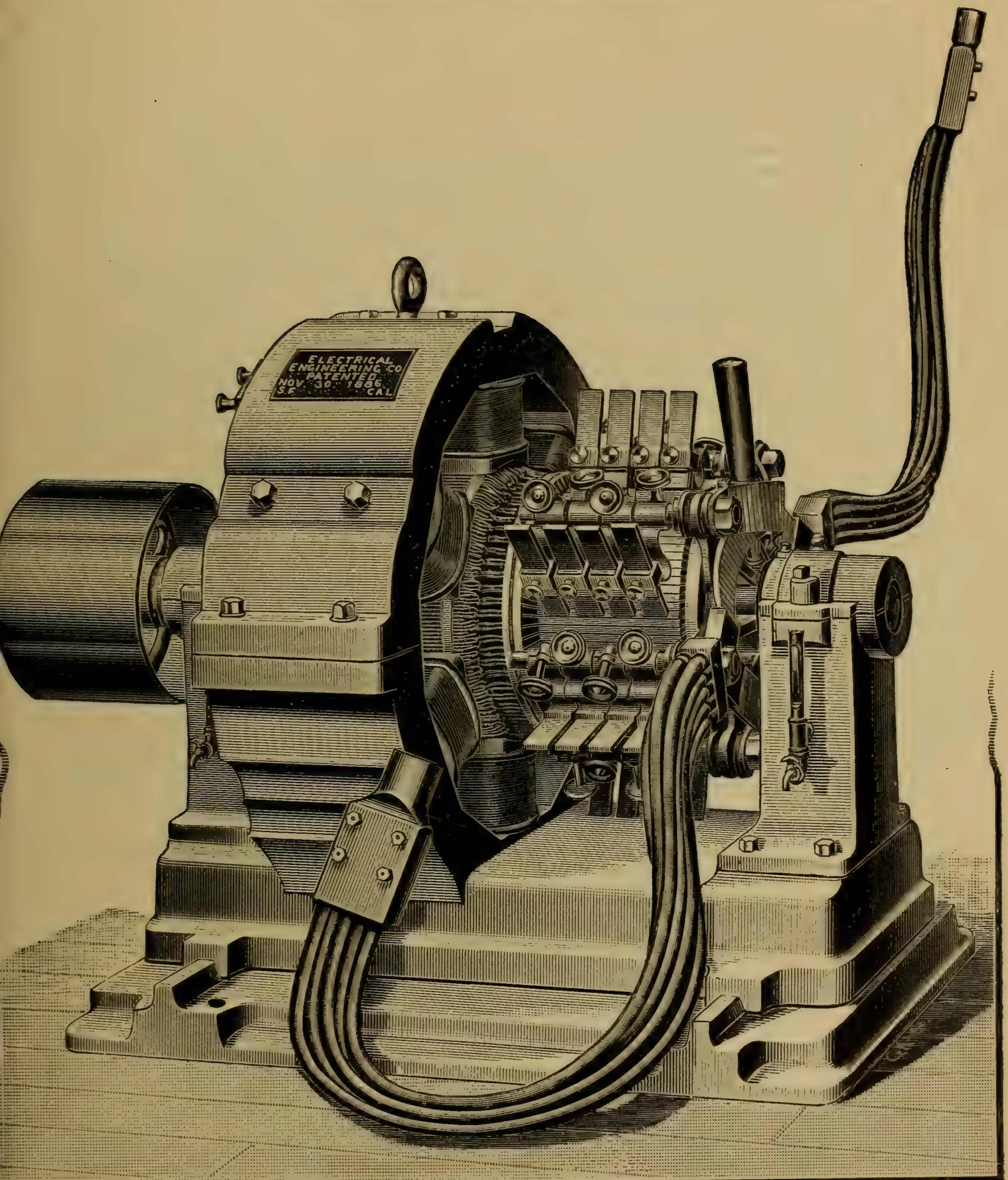
*No. 77, Page 754. "Regulation by Inertia."

Constructive Engineering on the Pacific Coast.

CONSTANT CURRENT ELECTRIC MOTOR.

THE ELECTRICAL ENGINEERING COMPANY, SAN FRANCISCO.

Hundreds of these motors are in successful operation on the Pacific Coast. They are provided with inertia governors, which secures perfect regulation under variable loads.



Constructive Engineering on the Pacific Coast.

MULTI-POLAR ELECTRO-PLATING DYNAMO.

THE ELECTRICAL ENGINEERING COMPANY, SAN FRANCISCO.

Six-pole separately excited machine of 15 volts, 1,500 amperes.—Adapted for electric smelting or welding.

of St. Louis, Mo., and Messrs. Sessions and Van Emon, of the Electrical Engineering Company. We will not attempt here a description of the Sergeant and Siemens methods, but try to explain the one last named.

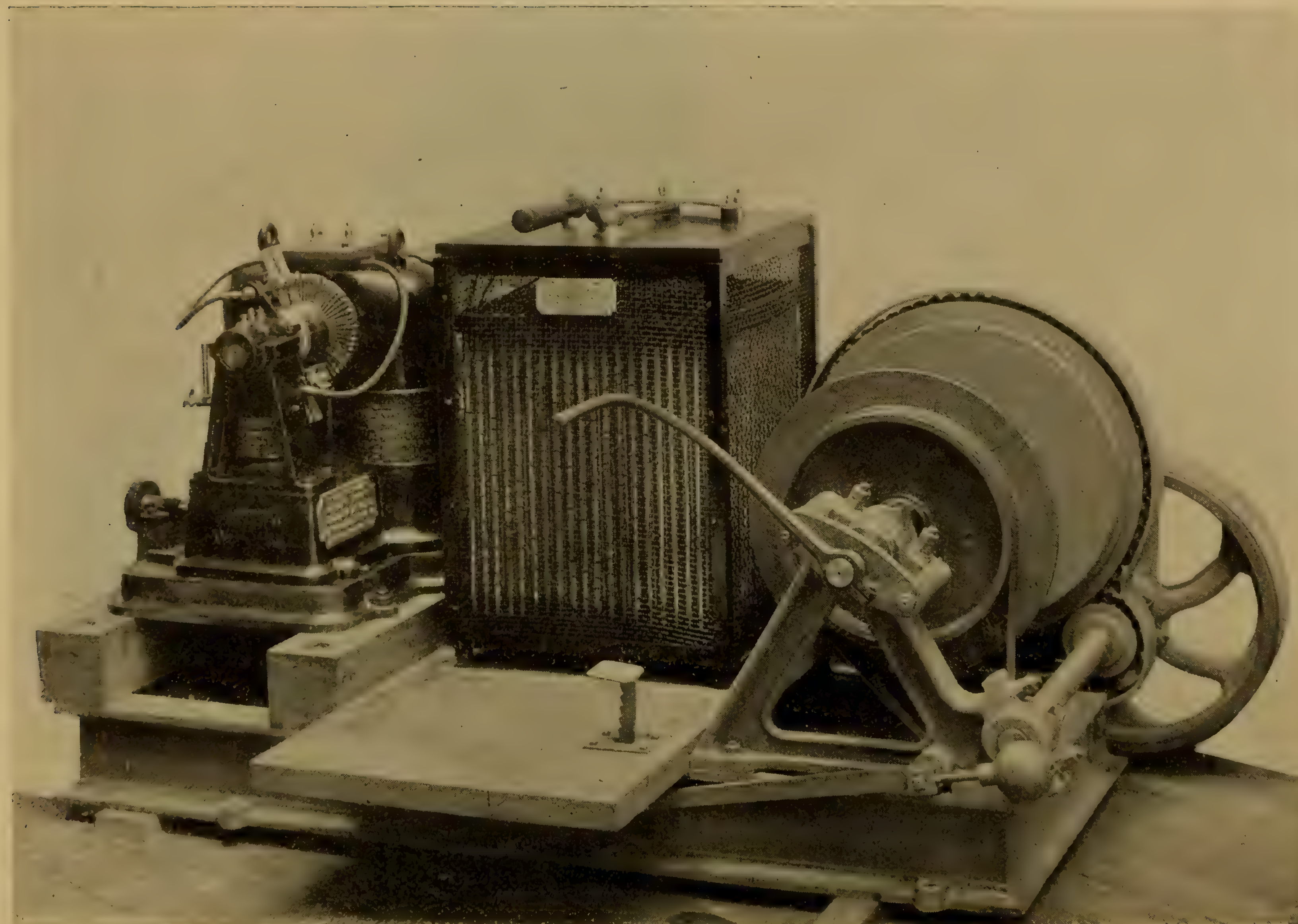
In all inertia-governing apparatus movement and force are derived from gearing interposed between the motor and some other element, moving in definite relation to the motor, that is, revolving with or connected thereto. If the speed of the motor changes, even in the slightest degree, there is a corresponding change of stress, and consequently in position, of the interposed gearing transmitting power to the second element. This element in Sergeant's invention was a separate unloaded motor, and in Siemens' a revolving centrifugal weight, but in the Electrical Engineering Company's system is the whole of the machinery driven, which supplies the inertia element; that is, the whole power or "torque" of the motor is transmitted "through the governor itself," or, to use other terms, the power of the motor acts as a centripetal force, and the centrifugal force of the governor is the driving power applied to the work to be done. It is like severing a shaft employed to transmit power, and connecting it with a flexible coupling. So long as the driving power is constant no movement takes place between the two sections of the shaft, but the least change of speed in the first mover alters the position of the two shafts relatively, the flexible coupling yields, and this latter movement acts on the regulating elements directly.

Present indications are that one or the other of the three systems named is to become a general method of regulation for power motors of all kinds where uniform speed is essential, and the application in this last and most improved form here, on this Coast, constitutes a considerable claim for engineering skill and enterprise in a very important class of machinery.

The immense rheostat, seen in the mining hoist motor on the next page, indicates a special practice that affords complete control in stopping and starting the motor, or change of load; also involves other electrical functions that we are unable to describe.

CONDENSING APPARATUS.

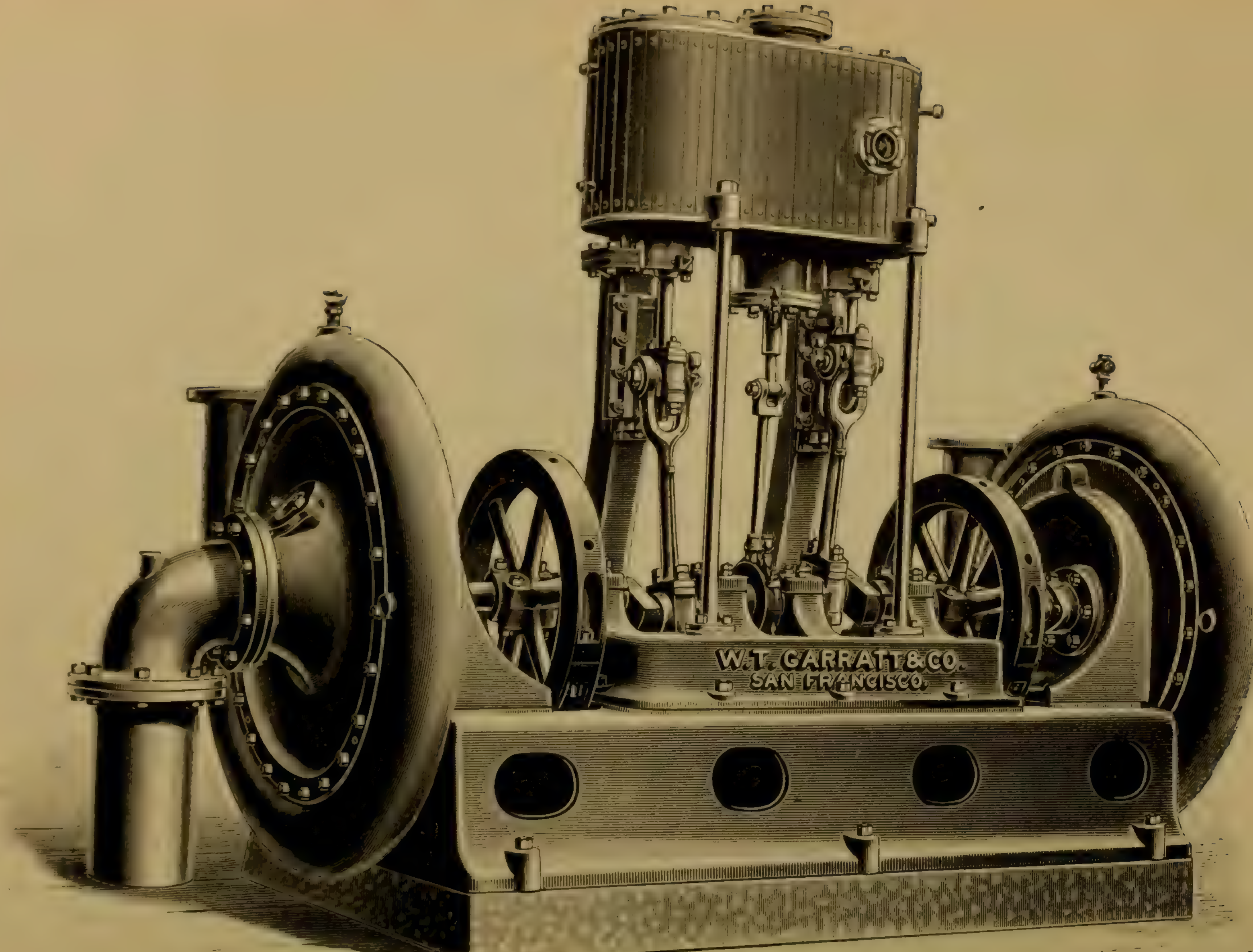
The high price of fuel, and also of water, on this Coast has led to various expedients for condensing that embrace nearly all the different methods known. In some cases with novel arrangements for circulating and cooling. Of these latter we will not attempt any



ELECTRICALLY DRIVEN MINING HOIST.

ELECTRICAL ENGINEERING CO., SAN FRANCISCO.

The mass of resistance coils gives complete control on varying the load.—No sparking occurs in any change or at any voltage.



Constructive Engineering on the Pacific Coast.

COMPOUND CENTRIFUGAL PUMPING ENGINE.

W. T. GARRATT & CO., SAN FRANCISCO.

Compound Engines.— Single steam valve.— These engines are made of similar design with pumps from 8 to 24 inches bore.— When large are provided with variable cut-off valves.

description, but will mention drawing salt condensing water from the Bay at distances from half a mile to a mile by means of pumps.

The first plant of the kind was erected by the San Francisco Tool Company about five years ago, and the scheme has since extended to a number of works, notably those of the Edison Light and Power Company, where the sea water to condense for 8,000 to 10,000 horse power is conducted about a mile to the main station through pipes of 24 inches diameter.

The variations of quantity required to meet the fluctuations of current for lighting purposes is from 800 to 8,000 horse power. This is met by a combination of centrifugal pumps that operate in series for the highest head about 75 feet, and by employing from one to four units of the pumping plant.

One pumping engine of the kind is shown on page 10, which for general design and efficiency has not been excelled in any country. As once before remarked, centrifugal pumps made on this Coast have been extensively treated upon in Numbers 72, 73, 74 and 75, of "INDUSTRY," ending in the issue for October of last year, and further comment is not called for at this time, so present remarks are confined to the general design of this salt-water pumping machinery.

The engines are compounded, both cylinders being served by a single distributing valve placed in the center, the invention of Mr. Eide, of Messrs. Garratt & Co., and the subject of pending patents. The sole plate, or main frame, is extended beyond the usual limit so as to receive between the bearings, fly wheels that are also couplings, and are required for convenience in turning the engines by hand. The pump wheels or impellers are of the disc pattern, 40 inches diameter, balanced for side thrust by water pressure.

The same company are now constructing a pair of 24-inch pumps to a similar design, but with triple-expansion engines, a further description of which will be given in a future place under the head of "Reclamation Machinery."

AERIAL ROPEWAYS.

Except in valleys, which comprise not more than a tenth of the area of the region known as the Pacific Coast, the country is mountainous and precipitous. Even the Coast ranges, lying near the ocean, rise from one to two thousand feet, and because of the abrupt slope, the country from Mexico to Puget Sound is furrowed and cut into deep cañons, in many places inaccessible for trade, and wholly

Constructive Engineering on the Pacific Coast.

EXAMPLES OF ROPEWAY PRACTICE.

THE VULCAN IRON WORKS, SAN FRANCISCO.

A section of the line at the English Mine, Nevada County, California.

so for ordinary means of transportation. Over these precipitous areas are scattered the main portion of the mining interest, timber, and other products. The *mesa* or high table lands and valleys up to elevations of two thousand feet or more are highly productive for agriculture of all kinds.

The Coast line, unlike that of the Atlantic, has no "bottom" lands; the hills having a sheer descent to the water. For a thousand miles along the Coast of California and Washington there are but few harbors, not more than six in all, where vessels can be moored and loaded in safety.

These circumstances on the Pacific Coast call for a wide use of aerial ropeways, and it may be said that for every one now erected there should be a dozen, to serve the urgent requirements of the country in mountain transportation,- vessels loading off the shores, and other like objects. The art is new, and the engineering problems involved are peculiar, without precedent, and call for bold ingenuity, marvelous to the public, and perplexing to the constructors of such lines.

Some inquiries at the Vulcan Iron Works, in this City, who make a specialty of aerial ropeways, develops the fact that they have constructed lines at various places along the Pacific Coast, from Puget Sound to, and in, Mexico, for conveying ore, fuel, grain in sacks and bulk, coffee, sugar cane, charcoal, also passengers and supplies.

The manager has placed at our disposal a mass of statistics in respect to construction of these ropeways, and the economy of their operation in many cases for service impossible by any other means, so whole industries are created by this system of transportation. He has also furnished particulars and drawings, showing the evolution of the system at the Vulcan Iron Works, but the space here at command permits only general mention of that matter.

The nature of the schemes is made more plain by the few plates herewith, than would be possible by a dozen pages of description. The views, which are by no means the most "rugged," were selected from scores of the same kind. Two of the illustrations are taken from a recently-constructed ropeway at the English Mine, in Nevada County, Cal., and one from a freight line at Pomeroy, Washington.

Some of the boldest work has been done in Mexico, where spans of 1,500 to 2,000 feet were made, the supports being set on precipitous cliffs, in valleys, and on the mountain sides.

Plans must include resistance to storms, lightning, snow, landslides, falling timber, and the maintenance of machinery on the

Constructive Engineering on the Pacific Coast.

EXAMPLES OF ROPEWAY PRACTICE.

THE VULCAN IRON WORKS, SAN FRANCISCO.

View of upper terminal of ropeway at Pomeroy, Washington, for transporting grain in sacks.— 6,000 feet long.— 1,900 feet fall.— 120 tons capacity in 10 hours.

Constructive Engineering on the Pacific Coast.

EXAMPLES OF ROPEWAY PRACTICE.

THE VULCAN IRON WORKS, SAN FRANCISCO.

A section of the line at the English Mine, Nevada County, California.

towers in inaccessible places. It is a romantic branch, carried out with danger, discomfort, toil and responsibility.

As a branch of engineering work, it is safe to claim that aerial ropeway practice on this Coast is quite abreast all that has been done elsewhere, modified of course to meet the various circumstances of each case and not directly comparable, except as to cost per mile for a given amount of traffic, and in this respect there is no doubt that engineers on this Coast are far ahead.

As remarked at the beginning, these aerial lines must in the future constitute an important fact in the industrial development of all mountainous countries having inaccessible minerals, fuel, or cultivatable areas, that cannot be reached by teams, or if so at an expense many times greater than by ropeways. In one case, described in "INDUSTRY" last year, a long line in San Andras, Mexico, paid back the whole investment, also maintenance, in one year, and this is not unusual.

In loading vessels where there is anchorage, but no harbor, a tower, or even a single column, set in the sea would enable loading from cliffs, as is now done in some places, but dangerously, by means of chutes. The Vulcan Iron Works are now considering such a scheme.

(To be continued.)

THE BROADER VIEW.

BY G. W. DICKIE.

A Lecture to the Engineering Students of Stanford University.

[Delivered at Palo Alto, Nov. 1st, 1894.]

When Professor Smith invited me to address the Engineering Class at the Stanford University, on some subject that might be helpful to you in your preparation to meet successfully the practical problems with which the future is pregnant for him who is to reach to even a mediocre position in the engineering profession, I accepted the invitation conditionally. First, that I should be able to find a subject outside of those that your studies bring you into contact with, upon which I might address you, and second, having found a subject, that I should be able to prepare such a treatment of it as would make it worth your while to thoughtfully consider what I might say.

I found a subject that had been in my thoughts for some time, although not in any definite shape, originating partly in my experi-

ence with engineer graduates, but taking more definite shape by reading expressed opinions of eminent engineers in respect to university training in engineering science.

Professor A. B. W. Kennedy, in his inaugural address to the Mechanical Science Section of the British Association said, "since I have ceased to teach, I seem to have been spending my time finding out how much better I could do it than was possible when I was actually engaged in teaching." This eminent engineer, a "past grand master" in the art of teaching the science of engineering, is forced to acknowledge that the broader field of practical engineering in which he must now exercise his talents, gives new ideas in regard to what are the most important elements in the education of the engineer.

I do not know whether Professor Marx or Professor Smith would have the courage to tell you that they cannot teach you to be engineers. No professor of engineering, no matter how wise a teacher he may be, can do that. They can teach you a great many things that it is very important for an engineer to know, but in acquiring all the knowledge possible from the physical and scientific investigations made in the laboratory or lecture room, do not forget that it is not so much what you know, but what you do, that will make you an engineer.

Now, I do not wish to be misunderstood, or to say anything that would lead you to suppose that I place a low value on the university training of the engineer. Here you are acquiring much useful knowledge, perhaps more than you will acquire in any other four years of your life, and my desire is to encourage you in your work, and at the same time point out to you certain tendencies in the University training to produce habits of thought and methods of working that may retard your future success as engineers.

The engineering graduate who has stood at the head of his class, is the pride of his professor, and has taken his degree with something to spare, leaves the University with high hopes that he expects will be immediately realized. He is armed at every point; has a ready equation for the solution of every problem ; he is prepared to do battle with every obstacle, but he finds no obstacle to battle with, only an invisible foe that never fights, and therefore cannot be conquered. He has not done anything yet to attract attention, so the world does not owe him any service. The world does not care about figures until you have done something that commands respectful attention, then the world would like to know how you figured it

out. But it is the weary waiting for the chance to do something that tests the character of the aspiring engineer. He may find a position in the draughting room of an engineering establishment. Here he soon makes the discovery that the qualifications that enabled him to stand high in his class and well with his professor, are entirely different from those that are required to enable him to stand well with his employer. The character of work that would result in the highest number of marks at a university examination is very apt to be just the kind of work that is not wanted in the draughting room.

In your physical investigations you are taught, and properly so, that no factor that has any bearing, however remote, on the final result can be neglected, for the insignificant things in any problem may under varying conditions become potent factors ; that what may be the small end of nothing in one relationship, may in another relationship become the leading factor. Therefore, every factor must be carried to its very end.

Now the careful investigation of every item that has any bearing on the subject under investigation, is of the utmost importance from an educational standpoint. Yet along with the patient work on every minute detail, must also be cultivated the faculty of quickly comprehending the whole subject in hand, and deciding what are the main factors that affect the final result. Without this faculty you can never accomplish much as an engineer. You must stand back from your subject far enough to see it all, and be able to comprehend what is important in the general result. If you get too close to the thing in front of you, it is apt to appear an exaggeration.

The other day I asked a young engineer graduate of a university to take out the weights of a surface condenser for me. After working on it a much longer time than was necessary, he brought me the result. He had 39,000 pounds of cast iron, which I knew to be about four times more than it ought to be. He had simply neglected to turn his cube inches into pounds! Now this little "slip" was not the difficulty in the case, that was the want of comprehending the proportion that one part of the design bore to another. Could he have realized the relationship of one part to another, in the plan before him, such a mistake would not be possible. It is hard for the university graduate who enters an industrial establishment, to feel that his carefully acquired stock of exact knowledge is not the commercial article, and is not held in very high esteem by those with whom he now associates. The head draughtsman under

whom he works may be entirely innocent of the knowledge that he has acquired. He may even use bad grammar in his explanations of the work in hand. In every point taken separately he, the university graduate, may be the superior of those far above him as engineers; and he is apt to feel that his training is all a mistake, and is a hindrance instead of a help. But as his power of comprehending the nature of things grows and develops with the experience that comes through the practical application of the principles and laws he learned the nature of as a student, he will find that the time spent at his university will continually grow in importance as he himself advances.

Engineering is not an exact science, especially mechanical engineering. Some portions of the work can be treated as an exact science, and others determined by experience; and if a recognized division of the work could be made, so that certain parts of an engineering problem could become the subject of scientific investigation, and certain other parts left to the mechanical instinct to supply, the education of the engineer would be a more simple problem than it now is; but the very parts that can be left to taste or usual practice in a design for one purpose, become the subject of the most careful calculation when the design is for some other purpose.

So it follows that the designs you prepare for educational purposes being ideal, with no practical result in view except the training of the designer, must, of course, in all their parts be the result of your investigation as to the duty to be performed, and the strains to be supported by each and every part. The strength of every kind of material has been the subject of laboratory tests. The dynamic condition of each part is investigated, and material provided to resist tensile, compressive, torsional, or combinations of these strains. Nothing from a purely scientific standpoint has been omitted, and yet after all this care and calculation you are surprised to find on comparing this ideal design with what is accepted as the best practice in machinery to perform the same functions, that there is little or no resemblance between them, and the great danger to you lies in the tendency to a conclusion in your mind that the reason of this difference is entirely due to the ignorance of the praccal engineer whose designs are so confidently accepted by their clients.

As an instance of wasting time on close computations where an exact result was of no practical value, I may mention one of many

cases coming under my observation in connection with our work for the Government. There are evidently in the Ordnance Bureau, at Washington, some men whose conscience will not rest unless the right-hand end of a long decimal can be verified. In submitting to the Bureau our detail plans for the turret armor of the *Olympia* our computations for the length of the chord of the outside and the chord of the inside surfaces of the plates were discovered to be incorrect, and they were returned for correction with, as is usual, no intimation of where the error was. Our men in going over the whole thing again, discovered some minor errors, and corrected them. Yet still it was not correct, and the plans were returned five different times as wrong. At last we insisted on knowing where the error was, and were informed that our computation of the length of the chord for the outer face was incorrect, and that the third figure to the right of the decimal point should be four instead of three. In other words, by our figures the plate would be one thousandth of an inch short.

Now these plates were to be "Harveyized," and the manufacturers have great difficulty in getting them out to within inches of the size, and that very same turret had to be rebuilt to suit the armor plates, which we were obliged to accept, although varying four inches from the plan dimensions. Here was a case of wasting time to work out the smallest fraction, when units could not be employed with any degree of certainty.

The ideal machine, with its every part proportioned to the calculated stress it has to bear, like the ideal man is a fine subject for study and scientific investigation, but neither the ideal machine, nor the ideal man, are fitted to meet successfully the actual conditions of every-day work.

Not long ago quite an eminent professor in mechanical engineering, talking with me on this subject, gave expression to his thoughts something like this: "I never could understand," said he "how so many mechanical designs emanating from the best men in our profession, and which have become recognized types giving general satisfaction, and where any marked departure from their leading features brings with it danger of failure, should be so widely different from what a purely scientific engineer would figure out as an ideal machine for the purpose." We were looking at a set of triple-expansion engines at the time, those of the United States ship *Olympia*. "Now," said he, "look at this crank shaft, and think of the torsional strain it transmits. In the forward journal, nothing;

through the next two journals of the engine is transmitted two thousand five hundred horse power, through the next two journals five thousand horse power, and through the after journal seven thousand five hundred horse power, and yet the shaft is the same size throughout. The eccentrics are all alike, both for going ahead and astern. Material is localized where it would not be required by any process of figuring. In fact," said he, "I can see that this design has been the result of calculation, but there is much more besides that has not been due to any result that figures would produce."

A mechanical design is very much like an animal structure. When you have figured out the strength required in every part, and given each its proper section and shape to resist the calculated strain that is to come upon it when the machine is in full operation, you have got the bones and muscle of a design to which experience must add the flesh necessary for a comfortable and satisfactory existence, and as nature is most liberal with flesh around the muscles that have the most work to do, in order that they may be properly nourished, so the experience of the engineer enables him to so clothe the muscles and bones of his design that those muscles that would otherwise become weakened by work are properly nourished and supported by an extra layer of flesh where most needed.

A sculptor or painter beginning to learn his art will use a manikin to get his proportions and attitudes, and his first efforts are apt to be very nearly reproductions of the manikin, but as his ideas broaden, and he gains experience in his art, the wooden appearance will disappear from his work, and life will begin to manifest itself in picture and statue.

So the mechanical student, in producing a machine design from his calculations of what each part should be, is likely to find a "manikin" as the result. In such condition work is not ready to be shown in public. It would be an indecent exposure of the design to show it thus. Get some clothes upon it. Look up the works of the best masters in the same line of mechanism. Try to comprehend why their work is so unlike yours. Leave your figuring for a little while and take a general view of what others have been led by experience to adopt. This will not of course give you experience, but it will remove from your mind some conditions that may very much delay your chance of acquiring experience, and it will enable you to go back to your design and fit a decent dress upon

it, so that it may make a creditable appearance in mechanical society.

My chief commented to me the other day on the difference between getting out preliminary plans for projected work today and how it was done eighteen years ago, when he and I were planning against each other on the big mining machinery required on the Comstock. It was then no unusual thing to be notified that a large plant would be required for a mine, and that the directors would meet next day to consider any scheme we might desire to propose. I have often taken a draughtsman home with me in the afternoon, worked with him all night, and be able to present next day the leading features of a design for machinery, to cost in some cases a quarter of a million dollars.

Today we do not seem to have the men about us who can work that way. Some lines go down, and days of figuring must intervene before more lines appear. The faculty of grasping the whole scheme, and retaining in the mind as a picture, enabling an elevation to be produced sufficiently accurate for the purposes of presentation without the necessity for plans and views, cross sections, and so on, is of the utmost value to the engineer who is expected to give important decisions involving large investments on short notice. This faculty of seeing the whole thing built and in operation in the mind before a plan is made on paper is a faculty of slow growth, and comes through practice and experience. It is this faculty that enables the engineer to decide often on the instant when schemes are presented to him as to their merits. As his eye gathers in the leading features of a design submitted to him for his opinion, a series of pictures pass in review in his mind of experiences with devices for doing the same work, and with these pictures come the impressions that each success or failure had left there. Sometimes the impressions cannot be indentified as belonging to any one success or failure, but they are there, and the sum of them all is his experience, and it is his ability to apply these mental impressions to the subject before him that gives his opinion such value in the eyes of the man or company who are to invest money in an undertaking.

You cannot leave the University with this power. No institution, however endowed, can give you this qualification. You must purchase it by patient labor, and perhaps through many failures. You are now learning the nature of all the things you will have to work with, and the laws that govern their use. This you should learn so well that school work will not take up your time when you

come to battle with practical applications, and while you must neglect nothing in your scientific course, however small its effect may be, let not this close investigation of small things bring about a contracted habit of mind if you have any ambition to fill a large place in the profession you have chosen.

Another faculty of great importance to the engineer is that of being able to get the most out of his eyes. An old foreman with whom I worked when a young man, when asked for instructions in regard to filling in work between two fixed points, was in the habit of saying: "Make it eye sweet, my son, make it eye sweet." I thought at the time that it was simply a habit that the old man had fallen into, but I have learned better since. We are very apt in engineering structures to think only of the scientific critic, and what his judgment may be of our work, forgetting that what may be perfectly satisfactory to him may be an offense in the eyes of those who like to look on things that are "sweet to the eye."

This is not, however, what I desire to speak of in regard to making the most of your eyes. An engineer has often to make rapid estimates of the probable cost of work, the plans of which are laid before him. The experienced eye can rapidly gather up the main features of the design, approximating the weights by a sort of computation process that will not be very far from the actual quantities when they come to be calculated in detail. The labor involved will also be graphically pictured to his eye as he surveys the plans, and his judgment as to probable cost will be near enough for the purpose of determining the question as to whether the project is within the means of those who are promoting it. I have found it a great help to the cultivation of this faculty to have as far as possible all drawings made to the same scale, say for general plans ¾ inch to the foot, and for details 1½ inches to the foot. It is astonishing what can be done by training the eye to proportions. In a general plan take a prominent piece and figure out its weight, then with the proportions of that piece in your eye, and the weight of it in your mind, you can try and set down the weights of every other piece in the plan by their relative proportion to the piece of which the weight is known. Practice at this, always working with the plans on the same scale, will soon develop the faculty of being able to approximately read off the weights of the several parts in any plan under inspection, together with the probable labor cost in their production.

This faculty is of great value to the engineer who may be

managing a large concern, and who has to give approximate costs off hand from a simple examination of general plans. It must not, however, even when it has reached a high development, be depended upon to take the place of careful detailed estimates, but even in the final estimates this ability to apportion the various parts is a wonderful help, and a prompt check on any great mistake being made.

Now I am not certain that I have suceeded in conveying to your minds the idea that I would like to impress upon you, some parts of what I have been saying might be taken to mean that I had but little faith in university training for the engineer. Such a conclusion would be a great mistake, and I would much rather not have addressed you than to leave such an impression on your minds. I would give a great deal today to be able to say that I had had the advantage of a university training in the science of engineering. Many times I have struggled painfully through an engineering problem involving the use of, to me, intricate mathematical equations that to you would be very easy work, and I have wasted years in gathering up unaided only fragments of what you should have the whole of when you graduate from this institution.

What I have gathered has been only what was absolutely necessary to meet my wants as an engineer, and many a time have I had to go hungry for the knowledge that would have lightened my labors. I am therefore not only in favor of the present course of engineering as given in the universities, but of extending it, and making it broad enough to embrace more practical work. Above all, I would like to see the students come from universities with clear ideas as to the practical application of the principles and laws that underlie all kinds of engineering construction. For, after all, the whole of this science of engineering, like all other science, is but the recorded and formulated experience of those who have labored before us in the same field, and our great danger lies in the supposing that when we have learned the use and application of the laws and formulæ that these men of experience have recorded in books for our instruction, that we have thereby acquired the experience of those who found out all these things and made a record of them. No method has been, nor is ever likely to be, discovered for teaching experience. I can buy experience for myself at the usual price, and can tell you what was paid for it, and after getting it may not be able to use it, or may throw it away, but cannot impart it to others. It is part of one's personality. It is a record of what one has failed to do, rather than what they have done, not recorded

in the symbols of language, or the numerals of computation, but in mental impressions that are an important factor in present efforts of all kinds.

All I ask of the young men who are now preparing themselves to begin the struggle for an honorable place among the engineers of this country, in some of the many branches of that honored profession, is to come into the field with minds well stocked with all the knowledge you can acquire. Your scientific knowledge cannot be too complete, but do not confound this knowledge of laws and principles with actual work. You are now being equipped with tools, the actual work is still ahead of you, and you will cut and slash yourselves a great deal, and careful capitalists will keep outside the reach of your sharp new tools until you have learned by experience how to use them without danger to others. Keep your minds sensitive to receive new impressions. Many of them will be painful and very costly to yourselves or to others, this is inevitable, but if faithfully utilized these costly experiences will in time make an engineer of you, and a better engineer because you began with a good kit of tools furnished and sharpened at this university.

A CO-OPERATIVE CONTRACT SYSTEM.*

The writer, from premises and observations not now remembered, more than twenty years ago, arrived at some conclusions respecting labor and wages, which at the time, so far as could be learned, were not commonly, if at all, entertained in this country, or set forth in books printed in our language.

These views while of an economic nature, were not derived from economic studies, but from a close association with and participation in skilled labor, that in all covered a period of more than thirty years, in widely diverse pursuits, from a country saw-mill in the Ohio Valley, to some of the foremost works in this country, in England, and to a limited extent on the continent of Europe, and in this experience the propositions above referred to and now to be stated have always been confirmed.

They are as follows:

(1) The *amount* of wages the world over is very constantly the same when measured by what the wages produce.

*J. Richards, in *The American Machinist.*

(2) The rate of wages is not an accident or the result of demand and supply, but a sequence of capacity or producing power.

(3) That the compensation for labor should not be measured by time in any pursuit when the product is obvious or definable, and labor should be responsible, not only for an equivalent of wages, but for a profit to the employer besides.

It is a pleasure to know that others of wider observation and greater powers have taken up the first two of these propositions, during five years past, and they are fast becoming established, not only as truths in industrial economy, but as absolute facts in the conduct of industrial affairs, the last and most complete testimony being that of Lujo Brentano, whose work on *Hours and Wages in Proportion to Production*, has been translated from the Italian language, by Mrs. William Arnold, during the present year.

The third proposition is much more intricate, does not admit of proof by familiar facts, and must be considered mainly from premises available only to those practically acquainted with the conduct of skilled industry, the technical affairs of works, and the characteristics of workmen so far as the latter are peculiar or distinct. It is this third proposition that I am asked to deal with in the present case.

Reduced to simple terms it is "timework" and "piecework." The first is easily understood; it is at this day, and has always been the common method of compensating labor, and is probably to remain so for certain kinds of service. An indefinite kind of contract based upon necessity, good faith or fear on the part of the the employed, philosophized and written about since the time of Adam Smith to Brentano, with no other solution than to agree that it is an unnatural human relation, and lies at the bottom of what we call labor disturbance. The term "piecework" is more comprehensive, and includes two very different systems of dealing with skilled labor, that have not, so far as known, been clearly classified or treated upon by writers on labor problems, who do not as a rule descend to the practical details of the subject, too often dealing with generalizations that, however true, have little practical value. The three systems referred to are as follows:

(1) Timework, in which men are employed to give their service for a stipulated period of hours, days, weeks, or months, for a specified sum, without conditions as to what the work will produce or earn, or responsibility of any kind beyond reasonable effort during the time.

(2) Piecework, wherein certain men are contracted with to produce a given amount of work or some special thing for a stipulated price. This is "personal" piecework, the most common in this country, and may relate to a few men in a shop, each dealt with individually; to a few men who act as partners in the work or to one or two men as contractors, who employ other men to assist, or to do the whole work.

(3) General or coöperative piecework, wherein the whole of the work is set off to estimates and the working force treated as contractors, so that all will participate in proportion to their skill and rating as workmen, or pro rata with the scale of wages.

Of the first two systems but little need be said. They are familiar to all who are engaged in conducting or performing skilled labor in this country, but the third method—which it is the main purpose of this article to explain, is by no means so simple. It not only changes the relation of the owners and workmen, but also the whole conduct of a business, as will appear further on.

For the purpose of explaining this method as it is carried out in England, in the machine works of the Lancashire district, for example, let us assume that a machine of any kind, of a certain weight and value, is to be built, and a shop operating on the coöperative contract system is called upon to send in an estimate upon it. The plans or design may have been prepared by a maker, the purchaser, or some one else; that does not matter, because we are to deal only with the method of construction.

The first thing is to assume a symbol or number for this work, and then proceed to "take out the quantities." This consists in dividing the work, which we call A^{10}, into four elements or components, namely: materials, labor, expense and profit. This is the work of quantity clerks, except as to profits and expense, which the owners will decide.

The material of all kinds is segregated and estimated at its cost. Every pound of iron, steel and brass, every bolt and nut, pattern work and painting are made out by men skilled in this branch. The incidental expenses are computed and added to the fixed expense, consisting of rent, taxes, water, light, advertising, and so on, these being based in most cases on the probable volume of the output for the year, and from precedent. Next comes the labor, which is not guessed at, but is made out by rules based on the finished superfices, turning, planing, milling, boring and drilling being put into classes and rated in proportion to the accuracy and

finish. The quantity clerks become familiar with this work and so do the workmen, so that a labor estimate made out by two persons, or one estimate made in the office and another in the shop, will not vary much. The labor and material and special expense estimates are sent to the manager and owners, who add the general expense and profit, and the whole is complete. The three elements provided by the owners, material, expense and profit, and the fourth element, that of labor provided by the workmen, make up the total. If there is doubt in respect to the labor, this estimate with the drawings is submitted to the foreman or leading men in the shop to be checked and approved.

Before going further with this job A^{10}, let us stop and consider where it stands. We have two agencies of production, the owner and workmen, each independent and each responsible. It is a neutral bargain resting on good faith and an equal pride in success. The workmen have nothing to do with profit; that is the owner's affair, and unless he taxes the work so as to lose the contract, the workmen want nothing to do with this part. There is no "profit sharing" in the case, because this belongs to the owners who assume the risk, provide the capital and transact the business, but the "labor" is another matter. This the workmen deal with.

Profits which are a problematic result under other systems, here become a certainty, or as nearly so as human chances permit, and for that same reason become uniform and reasonable.

To complete our example, let it be assumed that new workmen are to be employed. These are classified as turners, fitters, pattern-makers, smiths, moulders and apprentices, and graded for wages from twenty to forty shillings a week for workmen, according to their skill, and this rating is not a secret, as is sometimes the case in time shops, but is a matter known and dealt with by the men as a body, or by the foremen, and is an important part of the system, as will appear. The workmen being thus provided and classified, suppose that A^{10} is sent into the works under an estimate of two hundred pounds, or one thousand dollars, for labor.

Each man, whatever the nature of his work, who devotes any time to A^{10}, charges on his card all the time spent on work bearing that symbol, which he sees on the drawings. Each week he receives his wages which are apportioned between and charged to the various jobs he has worked upon. If half his time was spent on A^{10} that job is charged with one half his wages. He may be a fitter,

planer, turner, patternmaker, moulder or smith, that makes no difference.

Finally A^{10} is completed and then all the wages charged to that symbol or number are added together and compared with the original estimate. If these sums balance, the men get nothing more, if there is a balance due the shop, as there nearly always is, unless there has been an accident or other misfortune, the surplus is divided pro rata to every one who did any work on A^{10} in proportion to his wages. If there has been an accident that caused a loss on the labor estimate, it must be investigated to see if such accident was due to carelessness or want of skill among the workmen, or some fault of material, handling tackle, or other cause for which the owners are responsible, and an adjustment is made accordingly.

These divisions of surplus earnings are usually made up each month, and, as may be imagined, involve a great amount of clerical labor, but that is cheap and easy too, when the work is once learned, and it is excellent schooling for young men.

We have now traced A^{10} through the works hurriedly, but noting the main points. The method may not correspond to practice in various particulars, but shows substantially the system of responsible work. The next thing will be to examine the economic and social conditions of the system and its possibilities.

Whatever novelty there may be in the coöperative contract system, this is far supassed by the social and economic results. These will not at first be suspected, and it is only by careful consideration, that one will detect the many new conditions that will arise in connection with this method. One has already been announced — the uniformity and certainty of profit, which proposition many will be disposed to doubt, but it must be remembered that where profits are reasonable and uniform, competition adapts itself to these circumstances the same as it does to irregular and speculative profits. It must also be remembered that under a system of estimating such as the coöperative contract system develops, estimates and tenders are made very uniform. There is also a tendency to uniformity of quality and finish, or rather there is close correspondence between these things and prices, and as a matter of fact, the distribution of work is better than under a time or individual piecework system.

One of the first and principal things growing out of the system is an absence of shop supervision. There is no need of foremen or others to watch men, and see if they are diligent. Every man is

working for himself and his companions, and every man is watching others to see that they do not diminish earnings by carelessness, indifference or want of skill. If anyone is hired for wages above his grade, the workmen soon find this out, and he will stand in the light of an imposter, trying to procure the earnings of others unjustly. So the system not only does away with the espionage of owners, but grades the workmen according to the best possible standard, the judgment of men skilled and interested in the same work; so the coöperative contract system, as before remarked, dispenses with watching workmen and grading their wages, two of the most difficult things to deal with in a common shop under the time system.

(To be Continued.)

THE STATUS OF RAILWAYS.

By far the most important bulletin issued by the State Department, under the title of Consular Reports, is No. 170, for November. The main subjects embraced are the wages paid in Europe in steamship building and to the crews, in Austria, France, Germany, Italy, Holland, Russia and Great Britain, also communications from consular officers on Railways in Europe, giving statistics and facts respecting organization, conduct and rates in these same countries.

Referring at this time to the railway section of the report, it is timely. The issue of Dr. von der Leyden's circular in Germany, and that of Van Oss in England, on American railway securities has touched the pockets and, let us hope, the honor of the American people.

Consul General Mason, at Frankfort, Germany, who contributes a monograph on the subject, occupies in the service a very high position, and his writings on any subject always command careful and serious perusal. He is not an "appropriation patriot," but one whose concern is the honor and interests of the whole country, instead of the share that he or his friends have in the commonwealth. He says of Dr. von der Leyden's pamphlet, in the above-noted communication:

"It is neither possible nor necessary for the present purpose to rehearse in detail the statements and conclusions of this important pamphlet. American writers and financiers of the highest authority have concurred in pronouncing the present policy a failure, and

agree that some general measure of reform is necessary to restore public confidence in railway management, and rehabilitate their securities both at home and in the money markets of Europe."

The audacity of railway incorporations in this country, by their reckless methods, have been the main cause of the present disturbed and collapsed state of industry. Now they propose to injure, if not destroy, the National credit by dishonest administration. When they cannot pay their obligations, and the officers have wrecked the property of the investors, they go into the United States Courts and get themselves appointed "receivers," which means immunity against claims, but with powers to create new credits under order or permission of the courts. These receiverships are in effect no more than a pretended legal way of farther plundering investors. Of this Consul General Mason says:

"That railway presidents and directors enjoyed large prerogatives and immunities, and that the rights of security-holders were but partly protected by American laws, has been, of course, well known to European investors for years, but that a president or director who has abused his trust may be appointed as receiver of the same property, and, under such new mandate, continue his previous course, and that the accounts of an entire railway system may be falsified, and its securities sustained in the market by fictitious statements of earnings and concealment of rebates, all of which is believed here, are discoveries of comparatively recent date."

These things must cease. It has now gone far enough to rob people of their business and means, and now presents a barrier to foreign trade, on which our future prosperity and release from stagnation must depend. If railway securities are insecure, all other investments will be regarded the same. That some American railways are well managed Dr. von der Leyden admits, but no one has had the courage to call in question his disparaging statements, or question the truth and fairness of his criticisms and views.

In any attempt to improve the railway system in this country, obviously the first thing to do is to examine into what others have done. This is, indeed, almost the only thing that the common citizen and voter can do, and fortunately the Department of State has collected from the consuls in various European countries the very things that are required for such comparison.

In France the railways are thoroughly controlled by the Minister of Public Works and his staff under elaborate, just and inflexible laws that apply to the seven principal private lines, as well as the Government-owned lines. They are all treated as a Department of

State Public Works. For this control by the State the railways are taxed nearly $40 a mile to "compensate public service." Ten per cent. of all passenger fares go to the Government, affording from this source alone from 17 to 18 milllions of dollars annually.

The dividends to shareholders are limited specially for each line, and anything earned in excess of these amounts is divided with the government, which takes two thirds. What would the shareholders in this country say to such a regulation as this? One thing most of them will say in these times that they would gladly convert their holdings into French shares if such a thing were possible, because the Government there not only limits dividends but guarantees them, and if the earnings are not sufficient to provide the minimum dividend to shareholders, the balance is paid from public funds.

These provisions, and many more of the kind relating to finance, are the result of an "agreement" between the railway lines and the Government, entered into in 1883, eleven years ago. As before remarked, the whole system is governed by inflexible laws that are not, and dare not, be violated. The property or shares are stable, and a good investment, failures or "receivers" are unknown in the French system.

There is a pension fund for both temporary and permanent aid to the injured or retired workmen, and employed people generally. This fund at this time for one line amounts to $3,243,689; for another line, $2,983,827. Payments to this fund by the Compagnie de l'Ouest, in 1891, were $607,085. The Paris, Lyons and Mediterranean Line during the same year contributed to the pension or relief fund $823,004, and the employés $545,164. The reserve fund for this line amounts to $19,194,498.

There is, besides this munificent system, other organizations with the same objects. We commend these facts to those who are continually comparing the rate of wages in this country with the rates in France. It can be seen that the actual wages paid is not the only consideration for service. The whole is a consolidated system for the care while in service, and afterwards, of all who are employed. The State owns 1,656 miles of line out of a total of 24,015 miles of railway in France.

This system is, we imagine, the most perfect that now exists. It is based on the assumption that carriage by railway lines that pass over the surface of the country is a public function, and the government who grants the right of way and other powers to the railways must be responsible to the people for abuses of every kind

rendered possible by these delegated privileges. Railway property, as it is called in this country, is not in France put in the same category as other interests in which the public have no direct concern, but is recognized as a special and peculiar interest in which all the citizens are concerned, and for whose acts the government is responsible.

This is the true status of a public-carrying company, to which all railways in all parts of the world are tending, and where all must arrive in the end. Other countries are less completely reported by the consular officers, but the French system is the model approximated by all.

In Germany there are three kinds of railways. The Imperial, owned by the General Government; State railways, owned by the States, like Prussia, Bavaria, Saxony and others, and private railways, belong to companies as in this country.

The report on German railways, by Consul General Mason, is brief, because his former communications on this subject are so full that he has not thought it worth while in the present case to reproduce the matter. We will therefore say that the administration is still more elaborate in some respects than in France. The laws and regulations are equally inflexible in all that maintains a proper relation between the public and the railways.

Freight is divided into three classes, under which all kinds of goods must come, so the rates for all kinds of commodities are known and uniform. The rate for one kilometer, or less, is the same for all classes, and for greater distances the rate declines according to distance for the second and third class. The value and simplicity of this can be appreciated when we compare it with the complicated system here, where there is a special rate on hundreds of articles, changed continually, and assessed at "what the traffic will bear." There are, in Germany, funds provided for the injured and unfortunate, and for pensions after certain periods of service.

Consul General W. S. Jones, at Rome, sends an elaborate report on the Italian railways, of which the government owns 5,141 miles, is co-proprietor in 96 miles, and has ceded 2,795 miles to private companies. We will not consume space to go over the various facts presented by the Consul General, further than to remark that absolute control by the State is apparent in all features where abuse of privilege is possible, or where the rights of citizens can be infringed upon. The same remark applies to Russia, and we now pass to the railways of Great Britain.

The present consular report on the railways of the United Kingdom is merely a summary of totals, but the principal facts respecting these lines have been recently set forth in *Scribner's Magazine*, by Mr. H. G. Prout, under the head of "English Railway Methods."

British railways carry 67,200 passengers per mile worked, against 4,900 in this country, or fourteen times as many. The total earnings in 1892, were $20,000 per mile, against $7,720 in this country. This shows and accounts for the more expensive and elaborate system in England. The cost per mile is $227,000, against $63,700 here.

In 1892, 61 per cent. of railway stock in the United States paid nothing, while in England over 90 per cent. of the stocks declared dividends, averaging for the whole country 3.85 per cent. Since then this difference has been increased, so that shareholders here are not benefited by the loose and irresponsible laws under which our lines are organized and operated.

The Parliamentary expenses are a large item in the cost of a railway in Great Britain, not spent in lobbying, as people in this country might infer and sometimes claim, but in showing beyond mistake that a proposed line will be useful to the country, and is demanded by the exigencies of traffic, and funds are available for construction. This requires the presentation before Parliament of the whole scheme. Engineering, geographical and commercial features must be presented by men skilled in law, commerce and engineering, and is worth what it costs by saving people from bad investments, and in guarding the public against injury from the powers granted with a charter.

Of the management of British railways Mr. Prout says:

"Before dismissing finally the topic of the *personnel* of the English railroads we may properly glance at the attitude of the directors and superior officers toward the financial interests of the owners of the properties which they control, and toward the interests of shippers and other users of the railroads. The most competent authorities agree that English rates are stable and uniform, that every shipper may know what other shippers pay, and that he can tell what he will have to pay a week or a month from now; and most authorities agree, even the shippers themselves, that uniform and stable rates are more important to all interests than low rates. Furthermore, English railroads have for years been free from those scandals which so often come up in the management of American railroads, to the mortification of all patriotic citizens and to the immense injury of our credit. What is the reason for the better management in these respects of the English railroads? Is it legal,

or is it moral? To a certain degree it is legal, but to a far greater degree moral."

Of organizations for aid there is the following:

"Low wages are merely relative after all, and the cost of comfortable living in England is much less than it is here. Then permanence of place and the chance for promotion count for much, and we find that in our country the best roads, on which the conditions are most secure, get the pick of the men at the same or even lower wages. But in the English system still another element enters, that is, the provision for the care of the men. Taking, for example, the Great Eastern, there is a provident society, established 43 years ago, to provide a fund for the relief of its members in sickness, and pensions in old age, or in case of accident, and allowance in case of death of a member, and funeral expenses should his wife die.

* * * * * * * * *

The London and North Western has several funds of a similar character. The superannuation fund has been in existence over 40 years. This applies only to salaried officers and clerks. Membership in this is a condition of entering the service, but no person older than 26 is allowed to enter. Members contribute 2½ per cent. of their salaries, and the company contributes an equal amount. An insurance society was organized 23 years ago to provide for what are called members of the wages staff, which is for all grades below the salaried staff, and to this the company contributes a sum equal to five sixths of the premiums paid by the employees. The provident and pension society was established 20 years ago to provide weekly allowance in case of ordinary sickness for employees in the wages staff. Then there is a pension fund, established 10 years ago, for the same men, to provide a retiring pension for members after they reach 65, or for such members as having reached the age of 60 are no longer able to continue at work."

In respect to the chances of promotion we select the the follow- paragraph:

"The working force of the English railroads is actually democratic in spirit and results. One would not suspect this from an examination of the list of officers and directors. He will find there the names of 36 dukes, marquises, earls and viscounts; 35 lords of various degrees; 3 barons, and 109 baronets and knights, besides many officers of the army and navy, and a great many gentlemen whose social position permits them to put before their names the Right Honorable or Honorable. Probably this large proportion of men of high social position serves a good purpose, which I shall indicate later, but the men who really work the railroads are mostly drawn from quite another plane. A man of the humblest origin entering the English railroad service may hope to rise to the highest place."

Of the laws, or Acts of Parliament, and regulations of the Board

of Trade, under which the railways are operated, we need only say that the progress toward absolute ownership is every year advanced, and it is easy to see a time when private corporate powers will only be a name, and nothing will remain to be done but to convert the shares to consols. The process of "nationalizing" the railways is going on slowly but persistently, both as a policy of the government and a sentiment among the people. We do not mean by this that there is an asserted design of government ownership, or that the people have considered such a thing, but the workings of the laws and regulations must in the end force this result, because the people demand even more stringent control than now exists.

In these facts, selected at random, there is indicated the future course to be followed in this country. Nowhere else in the world have railway incorporations attained such a position as here, where a government of 65 millions of people is put on the defensive against a power supposed to be of their own creation, a power that is wrecking the political, moral and commercial institutions of the people, not in the interests of shareholders, or even of the lines, but the interest of individuals. This aggression of persons has its foundation in the principles of discrimination before the laws, an individualism opposed to true freedom and subversion of all public good.

LAND VALUES IN CALIFORNIA.

Among many disturbing causes for the present, and serious problems for the future, is the value of farming lands in this State. It is common to assume that everything depends upon the agricultural interests, and while such an assertion is in some degree true, it is not wholly so, because great cities and prosperous communities have been built upon commerce alone, also on manufactures.

The truth is, however, that the principal industrial interest in California is agriculture. The great fertility of land and its wonderful productive power, together with climatic conditions that make it desirable for homes, has raised prices to a point that by fair inference is double what they should be, and how this is to be adjusted is, as before said, a serious problem of the future.

The value of anything must be based upon one or both of two considerations, its productive power or use for residence. For productive use the price of land must follow what the land will earn, or as the term is, must be capitalized on its earnings. The California

farmer has been compelled since 1890 to divide his products by two. Wheat and fruit, the principal things produced, have certainly changed this much, and there seems to be no promise of increase in prices for the future. In wheat there certainly is not.

The crop of the Argentine States this year will be in amount about double the highest yield of California. Chili, Uruguay, and other South American countries, are fast increasing their product at prices below what is asserted to be the cost of growing wheat here. In the latter country, scarcely heard of before as a wheat-producing one, 50,000 tons awaited shipment in October.

In fruit of the standard varieties the same rule applies. Prunes that last year brought a fair price are sure to follow other kinds of fruit when the immense acreage now planted comes into bearing in two and three years hence. In Lake County, thirty miles from a railway, or other means of shipment, except by teams, we recently saw a single orchard said to contain 300 acres and 40,000 trees. This was but one out of many in the same district. In the head of the Napa Valley, within a few miles above Calistoga, the new prune orchards are estimated at 1,000 acres, or 130,000 trees. These are but two districts out of a hundred or more in this State, where the same circumstances exist.

Wine will, no doubt, advance in price if the production is checked by the present unprofitable prices, but not a great deal, or so much as to alter the "division by two," if compared with five years ago.

Some of the finest lands in Napa Valley, the garden of the Bay district, sown in hay this year, produce in rent about $3.00 an acre, rating hay at $8.00 per ton on the farms. This, capitalized at six per cent., reduces land values to $50 an acre, instead of $150, at which the best lands have been rated. The average product may be more than the above, the figures are made up from a typical case on lands of the best class, rented for one third of the crop, producing about a ton to the acre for the whole farm, making allowance for other necessary uses of land.

Horses and cattle, taken together, have suffered a decline nearly the same as wheat, wine and fruit. Pork and dairy products are better maintained, but on the whole one rule exists, that of a "division by two" compared with five years ago. No such change has taken place in other values, and is not likely to in the future. City and mining property and manufactures have not declined more than one third as much as farm products of the staple kinds named.

The farmer seems called upon to bear the brunt of the battle, and is entitled to whatever can be done to lighten his burthen.

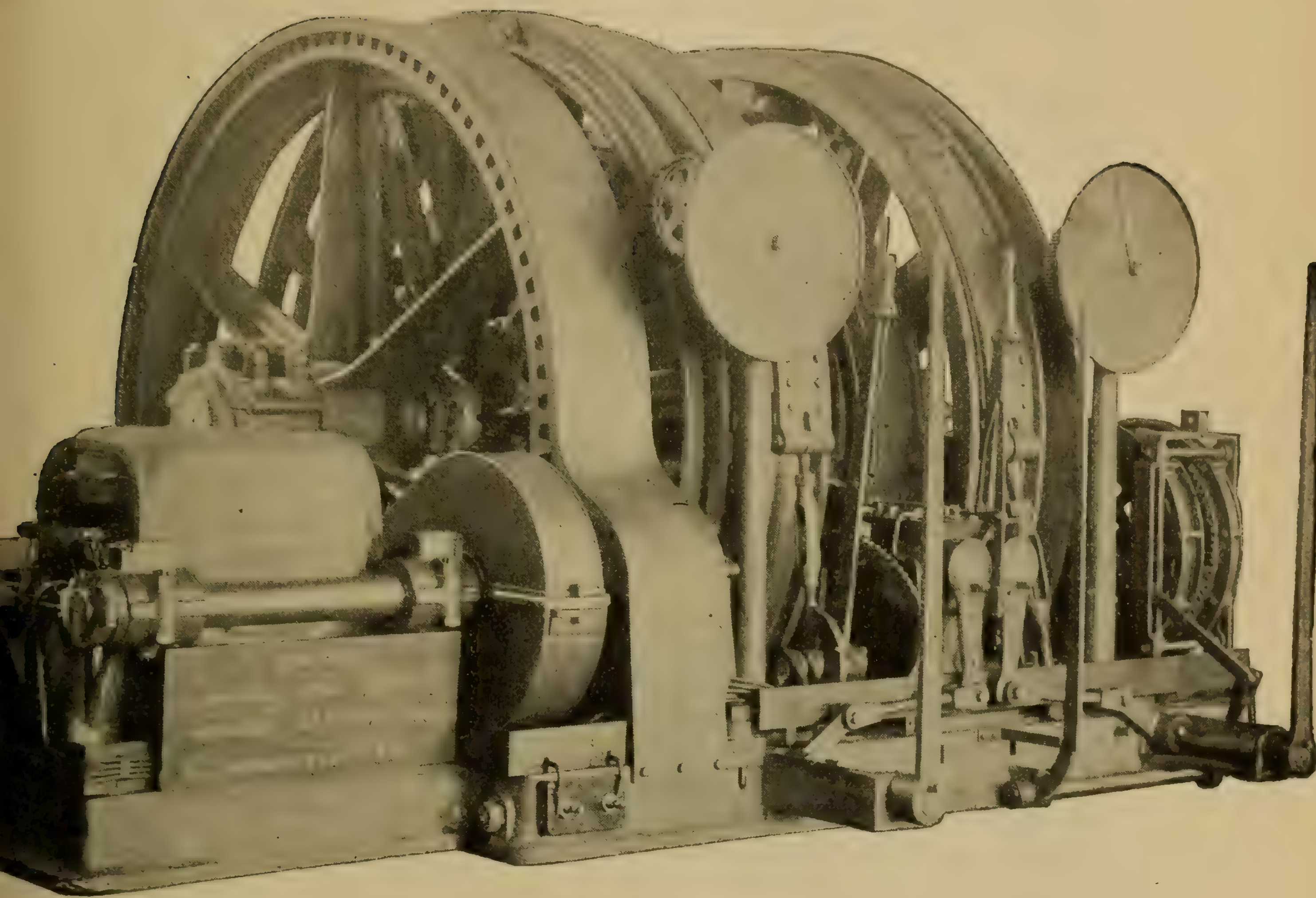
Land values are slow to change, and are sustained by the powerful interest of mortgage securities, but some years of present prices for agricultural products will lead to the inevitable balance that must follow the adjustment of relative prices.

It must not be forgotten, however, that out of this decline in values may come the same result that twenty-three years ago brought about specie resumption, and a period of wonderful prosperity by an increased foreign trade. In this lies the hope of California. The home market, that is, the country lying east of the Rocky Mountains, is in effect more distant than Europe or Asia, because it costs more to send California products there. The people in this home market do not number one eighth of the customers in Europe, of like civilization and consuming the same products, nor one tenth of the people in Asia, Australia, and South America, that would gladly consume our flour, fruit and wine if the circumstances of commerce, reasonable rates of carriage, and a free exchange of commodities permitted.

These propositions are, however, too distant from the present facts to have much influence in the readjustment of agricultural land values that are likely to follow in the next three years.

The causes that have brought about these great changes in the price of agricultural products are not hard to trace, but no matter how well understood cannot as examples stop the wave of modern speculation and rotten securities that react on all industries alike. The hundreds of millions of dollars that have passed into private hands without tangible consideration the other way, must be drawn from the country's industries and commerce. There is no other source for its creation, except for that part that has been drawn from foreign investors by dishonest schemes.

A ready table of reference for metrical quantities has become necessary to business men and engineers. The publishers of "INDUSTRY" send this month to each subscriber a reference table to be pasted up, or pasted down, and retained for reference. The table is one issued by the Government under an Act of Congress calling for promulgation periodically of such measures, coins, and the like.



125 HORSE POWER ELECTRIC MINE HOIST.

THE GENERAL ELECTRIC COMPANY.

We, last month, mentioned a singularly compact and complete design for a mine hoist, furnished for a silver mine by the General Electric Company, and now publish the engraving above, showing the machinery in perspective.

On this Coast there is no need of an elementary description of machinery of this class, every detail, other than the electric elements, is plain to our readers, or at least so many of them as are connected with mining affairs.

The company send the following particulars of the machinery:

"The large electric double reel, flat-rope hoist is probably the largest ever made, and has just been completed by the General Electric Company. It nominally works in balance, and has a capacity on each side of 5,000 pounds, the mean speed of the rope being 500 feet per minute. The motive power is furnished by a General

Electric 125 horse power motor of the L. W. P. 20 type, similar in size to the large ones used to propel the cars on the Intramural Railway. The lower frame of this motor is provided with feet, which allow it to be bolted to the bed plate of the hoist.

The maximum demand on the motor will be about 80 horse power when the hoist is working singly. Under normal conditions, that is when it is hoisting in balance, the demand will be about 50 horse power.

The hoist itself is extremely compact, the dimension of the base exclusive of the motor, is about 9½ feet square, the width being increased by about 3 feet 4 inches by the addition of the motor. The height is about 7¼ feet above the foundations, the reels, however, extending a little below the level of the bed plate. The reel centers are four feet apart, and have a capacity each of 1,000 feet of flat rope, ⅜ × 3½ inches. The diameter of the naked reel is three feet, this when wound with the rope is increased to eight feet. On account of the direct relation between the working diameter of the reel, and the weight of the rope unwound, which forms a considerable part of the load, the work done by the motor remains practically constant.

The brake rings are keyed to the reel, and are 7 feet 6 inches in diameter, with an 8¼ inch face. Each is designed to allow for expansion of the brake when lowering, which heat may bring about. The reel shaft is of steel six inches in diameter, the journals being increased to eight inches at the center, and run in bearings, lined with anti-friction metal, and adjustable. The indicators on the front show the position of the cages.

The weight of the hoist is about 3,200 pounds, and no part is so large but that it can be lowered into a mine, the tunnel of which is 7 × 8 feet."

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

This Society met at their rooms, 819 Market Street, Dec. 7th.

Mr. Carl Leonard, of Los Angeles, technologist, was elected a member, and Maris Capuccio, of San Francisco, draughtsman, was elected a junior member of the Society.

A nominating committee was elected to prepare and present names for officers of the Society for the coming year.

Mr. W. G. Curtis, C. E., of San Francisco, read a paper giving a description of a timber-preserving plant, such as has been in operation by the Southern Pacific Railway Company for the treatment of timber used in their structures.

A communication was received from Mr. John C. Trautwine, Jr., of Philadelphia, in respect to an affiliation of the Technical Society

with the Association of Engineering Societies, of which Mr. Trautwine is Secretary. The matter was referred to the Directors of the Technical Society.

There was also announced a scheme of combining the Technical Society with the Mechanics' Institute, of this City, and a committee appointed to consider that matter. This committee, consisting of Messrs. Vischer, Wagoner and Browne, will confer with a similar committee of the Mechanics' Institute in respect to a coalition. This latter seems to be a most desirable consummation. The Technical Society is "too technical," and the Mechanics' Institute not technical enough. There seems to be a great balance of "pro" reasons, perhaps there are also "cons." It is by no means a simple problem the committees have to deal with.

JONVAL WHEELS AT NIAGARA.

Mr. H. H. Suplee, in *Cassier's Magazine*, writing of the Jonval turbine wheels furnished to the Niagara Falls Power Company by Messrs. R. D. Wood & Co., of Philadelphia, designed by Mr. Emile Guyelin, says that supporting the wheel and shafts by water pressure was a "stroke of genius." We do not want to disparage Mr. Suplee's well-written account, or the skill of the eminent engineer who designed the wheels, but will remark that if the wheels had not been so supported the practice would have been bad indeed. In the light of present engineering knowledge a centrifugal pump or water wheel having their axis vertical, and not supported by water pressure, should be classed as "incompetent." Some of the turbine designs for the Cataract Company had hydraulic steps to sustain the shafts, and were denounced in "INDUSTRY" for that reason. The Faesch & Picard designs adopted have, as we believe, a water-pressure balance. The method of sustaining the weight of vertical shafts by centrifugal force, a much more ingenious and elaborate method, was invented on this Coast in 1865 by Prof. F. G. Hesse, now of the University of California, it includes and much exceeds the idea of an inverted water wheel. See page 19, Centrifugal Pumps, 1894; also "INDUSTRY," No. 73, page 469.

LITERATURE.

Report of the U. S. Commissioner of Navigation, 1894.

With all the a tention given at th s time to the foreign shipping interest there should be something learned if not done. The Report of the U. S. Commissioner of Navigation is at hand, containing nearly 400 pages, and at the same time No. 170 of the Consular Reports, containing communications from the consular officers in Austria, France, Germany, Italy, Holland, Russia and Great Britain, giving a list of the wages paid in shipbuilding yards, and the pay of crews in the several countries.

This last-named matter will receive some attention next month, for the present we will give some quotations from Commissioner Chamberlain's Report.

In respect to our antiquated Navigation Laws he says:

"I have the honor respectfully to recommend that Congress be requested to permit the gr wth and development of American navigation by repealing a law enacted fourteen years before Robert Fulton's steamboat navigated the Hudson River, and a quarter of a century before t e first steamship crossed the Atlantic — when, in brief, the methods and requir ments of over-sea navigation were as radically different from those which now obtain as are the conditions of land transportation today from those before the revolution worked by George Stephenson's locomotive in 1814."

Of registry there is this remark:

"A registry law cannot prevent the citizen from buying abroad all the ships he chooses. By expatriating shipping thus bought it merely augments the commercial importance of the nation under whose flag the owner must take refuge, without creating one additional day's labor for one man, one additional dollar's chance for investment in domestic shipyards.

The results of resort to the three courses open to American citizens are close to the surface of our statistics. From New York and Philadelphia last year six steamships under the American flag crossed the Atlantic, while from those two ports thirty-three steamships owned by Americans crossed the Atlantic under foreign flags."

On taxation:

"As a rule the seaboard and Lake States tax shipping as other property is taxed, regardless of the facts that maritime nations usually impose no taxes on shipping as property, but tax only the actual earnings of shipping, and that, from the very nature of its use, shipping cannot share in the benefits which are bestowed by the distribution of the proceeds of State and municipal taxation for public purposes. A moment's review of the various public purposes for which the proceeds of State and local taxes are usually expended will show that shipping derives little or no benefit from them."

At this port the taxes collected off shipping last year were $85,675, on a valuation of $5,354,675, while the taxes paid for the same period by theCunard, North German, Lloyd and Hamburg lines, on $35,397,043 was $5),089. The proportion is roughly as twelve to one. How are we to compete in ocean carriage on such terms as these? But this is not all, the port charges arê equally oppressive at various places, and highest of all at San Francisco.

On the whole the present report makes plain an unmistakable hostility to the merchant marine of this country, and a corresponding favoritism for railways. The cry for subsidies is inconsistent, born of the idea that finds expression in "the flag and an appropriation." If our vessels were let alone, and placed on the same basis as in other countries, the interest would soon expand. England, with over 5,000 steam vessels, has no subsidies, and not three per cent. of her ships have mail contracts, which in this country are rated as subsidies. Government aid may be expedient, but the first thing should be to remove Government obstruction.

Hours and Wages.

BY DR. LUJO BRENTANO.

[Charles Scribner's Sons, New York.]

In this work we have at last some glimmering, or indeed a full ray of light, on the labor and wages problem. Had any other branch of human economy lying under people's noses, a matter of daily and hourly contact, remained without rational understanding as the wages' problem has, it would cause doubts of human reasoning powers.

Here is cited hundreds of cases as facts to show that the "rate" of wages is not an

economic element, but rather a social circumstance, and that the "amount" of wages as an element in production is a wholly different matter. There are not only facts, but clear reasoning and logical explanation of the laws that govern wages, their relation to production and the hours of labor.

Dr. Brentano has the advantage of viewing impartially the great industrial nations, England, France, Germany and America, and has made good use of this privilege. The work is translated by Mrs. William Arnold, who has done her work well, rendering it into plain idiomatic English. 143 pages, price $1.00.

The Practical Designing of Structural Iron Work.

BY PROF. HENRY ADAMS, C. E., CITY OF LONDON COLLEGE, LONDON, ENGLAND.

Sent by the publishers, Messrs. Spon & Chamberlain, New York.

This work removes one of the principal objections to mathematical treatises on stress in structures, that of being complex, and unavailable for that reason to any but highly educated engineers and architects.

The scheme of the work is not elementary, but is plain, and the solutions largely arithmetical, comprehending not only strains but the nature of materials and constructive expedients that enter into the practical design of beams, girders, columns, joists and so on.

Prof. Adams, one must infer, is conservative and intensely practical in his methods, and as a teacher has here set forth in a compendious way the fundamental principles that lie at the bottom of static structures of metal, and also to some extent of wood.

One thought that will occur to most people on examining the work is the place it supplies in a much-wanted class of technical literature, that of the engineering element in modern architecture. It is hard to say at this day which of the two professions, engineering or architecture, has most to do with business buildings as they are now constructed. The present work is a link joining the two, as it were, supplying to draughtsmen and designers in either profession a short and easy solution of all required problems coming within the title as it is written.

We have no hesitation in recommending this work to practical people, believing if it had no other merit, the shortening of methods for calculation will alone in a short use pay back the cost of the book. Price $3.50.

Political Reform by the Representation of Minorities.

BY M. N. FORNEY.

[Editor and proprietor of the *American Engineer*, N. Y.]

This work will be a surprise to those who have known Mr. Forney through his serial writings for thirty years past, and as an author of standard technical publications, especially to understand how he has found time to study the subject set forth in the title above. Such astonishment will extend to his personal friends even.

The subject is treated in a manner showing the analytical method of the engineer. Political science, or methods rather, because "science" does not apply to what cannot be computed and proved, needs just such treatment as is here displayed. We have, since the founding of INDUSTRY, concontended that no kind of knowledge pertaining to economics can progress beyond "opinions" until dealt with mathematically. Faith or belief in political propositions may come from arguments and inference, but "conviction" must rest on truths that can be proved, and nothing can be proved except by mathematics, that is by establishing definite relations and results in accordance with natural laws.

Mr. Forney's work is on these lines. Graphic demonstrations, formulæ and facts make up the elements brought to bear, and the wide range of research is indicated by a list of bibliography covering eight pages of the work, relating to the main and corelated subjects. The book not being one of views or arguments does not admit of review further than its method or scheme.

The subject of how to ascertain and apply consistently the votes of electors is coming to the front, and must form an indispensable part of a reform in the present system, the continuance of which is scarcely supposable, especially in the cities of this country. Mr. Forney treats of "method" just as he would in a case of constructive engineering.

It is published by the author, at 47 Cedar Street, New York, contains 199 pages, 6×8½ inches, and is sold for $1.50.

LOCAL NOTES.

Our notices of books is quite incomplete in the present number, owing to a lack of time to examine them, and also want of space for the matter. In this latter thing we are reminded of a kindly interest taken in "INDUSTRY" by its numerous friends who contribute to its pages. Since it was founded, in 1888, the reprinted matter has formed but a small portion of the whole; not that such matter might not have been better; the circumstances on this Coast permit and invite reprinting, but there has been an aim to present original matter up to the limit of commercial possibility. The number of pages have been a little reduced by the depression of last and this year, but will be added as soon as the revenue permits. The effect of reduced prices on most everything else has not reached the elements that go to make a publication of this kind. They fall on the revenue alone.

Mr. I. M. Scott, general manager of the Union Iron Works, has recently lectured before the Academy of Sciences, on the subject of manufactures on this Coast, or the want of them rather, and has shown in an astonishing manner how the people prefer to buy from abroad what they have every natural facility for making at home. No one more than Mr. Scott understands this matter, and no one has done more to promote an opposite policy, but we fear that even his striking presentation will not do much good. There are always people of a "brigandish" nature to spoil the reputation of those who conduct a fair and equitable business, and the main impediment here is a want of confidence. If, for example, machine work was made to exact and uniform estimates there would be no sending East for such work. An overcharge for $10 worth of work sends away $10,000. Confidence is the main point of all, and this is destroyed by little things. The besetting sin here is irregularity of prices for other than contract work.

In October wheat sold in New York at 56⅛ cents a bushel, or 84 cents a cental, and a report says Argentine wheat will this year be sold in London at 15 shillings a quarter. This means a cessation, if not an end, of the wheat export trade for California, and that one of the principal industries must be supplanted. In 1880 the yield

in California was 1,626,868 tons, or more than $45,000,000 in value, and then declined in price and volume so rapidly that in 1885 the yield was only 761,739 tons. Since then the export for wheat and flour trade from California to Asia and Australasian ports has, to a great extent, been supplanted by Oregon and Washington, who ship by the Canadian Pacific steamers. Mr. Horace Davis, of this City, who was long identified with the wheat and flour interests of the State, says in the *Journal of Political Economy* for September:

"I grieve to see the State wearing out its soil to give cheap bread to Europe, and every new product that can be raised profitably gives me new satisfaction. Smaller holdings, with diversified farming, is the indispensable condition of prosperity here; and I look forward to the time when this huge bulk of wheat shall be cut down one half, and for it we shall substitute a hundred different products requiring more labor, more skill, more industry, and returning us more profit and greater prosperity."

It is the custom on this Coast to write in contracts and price lists "United States gold coin." It is bad policy in a commercial sense. Other words will just as well express the sense intended, and not be offensive to people of other countries who have gold coin of a different denomination. Advertising matter is construed literally by people of other languages, and a Spaniard, Frenchman or German cannot see why the gold coin of his own country is not as good as the coin of the United States. It seems natural, now that people have become accustomed to it here, but it sounds provincial to a stranger, and is in "restraint of trade." Any banker or merchant can in a moment translate money into the terms of other countries, and as there has been no discounted medium of trade in this country for twenty-two years past, there is no need of expressing values in other than dollars, besides the phrase as a statement is not true. Anyone here is only too glad to accept American notes, pounds, francs, doublooons, Napoleans, or any other kind of convertible money at its exchange value in dollars.

The Fulton Engineering and Shipbuilding Works, of this City, are to construct and erect the air-compressing, hydraulic and electric plants for the dynamite guns at Fort Winfield Scott (Fort Point), in this City. Mr. E. A. Rix, as engineer for the Fulton Company, went East to examine the plants and confer with the Pneumatic Gun

Company, at New York, and after submitting his plans secured the contract for the company above named. The steam plant is to be of 700 horse power. The pneumatic machinery compresses at three stages to 2,000 pounds per inch, which, compared to common pressures, is almost inconceivable. The electric apparatus is to handle and train the guns, immense tubes 50 feet long, 15 inches bore, from which projectiles 11 feet long are discharged by air pressure. These, filled with delicate apparatus for firing, can be thrown 2¼ miles to 4 miles. The largest projectiles contain 500 pounds of dynamite. Two smaller sizes are to be used, 8 and 12 inches diameter, a jacket of wood filling the bore of the gun. The giving out of this contract here is a very creditable matter, both as to enterprise and the skill recognized in the designs, especially the pneumatic part, which has for many years past been a specialty with Mr. Rix, and now an important department of the Fulton Works.

In the testimony given during the late "Potter trial," in this City, it seems that the price of a column of matter in the daily papers, published in some interest is $300. There are happily some people who would not esteem it worth three cents, and a good many more who would not purchase insincere matter of the kind at any price. The principal business of a newspaper now-a-days seems to be to collect blackmail, and sell their pages for money. Of course there must be some pretense of independence and honesty, but it is only pretense. A good many years ago an agent of one of the principal daily papers came to the writer to solicit pay for "writing up" an exhibit at a Mechanics' Fair in this City. It was a new scheme, not understood then, but since that time we have never read with confidence anything published in that paper, and never can.

An appropriation has been made by Congress of $150,000, for the preliminary work on a ship or boat railway around the rapids called the Dalles in the Columbia River. The scheme as announced is to be a "haul out" system, the cars being sunk, the boats brought over them, and the whole handled by steam or water power, raised 70 feet and then carried around the rapids on several pairs of rails. There have been a good many schemes of this kind, from the time of Captain Eads' Tehuantepec one, down to the Chignecto in Nova Scotia, the latter partly done, but nothing practical has been

accomplished. A canal and sluices seems a good enough way to move boats around falls or rapids and a more natural expedient than wheel tackle for the purpose. The work at the cascades, below the Dalles on the Columbia River, has been going on for many years past, whether with any gain on decay and destructive action of the river, we do not know.

The *Railway Review* speaks of the foundations going in at the city front here to receive the new passenger stations, and says the ground and buildings belong to the city. The *Review* is wrong, San Francisco is an inland City, with no rights on the water front except to pay tolls. The City does not come within two hundred feet of the Bay, and does not own a foot of dock front. Vessels owned here pay municipal taxes, but do not use anything these taxes provide, besides must pay the State for the privilege of landing and lying contiguous to San Francisco. On the other side at Oakland, the railway company claims the water front, and will not permit any landing or business they can prevent, except their own. They also use most of the streets in San Francisco. The citizens have but few rights outside their own premises.

We examined recently at the Byron Jackson machine works, in this City, two reclamation centrifugal pumping plants, one a 30-inch pump of 100 horse power for the Staten Island Drainage District, and a 300 horse power 44-inch pump for the Pierson District, both on the Sacramento River. For simplicity of arrangement, excellence of workmanship and material also, this work is hard to excel. The smaller plant is built on a continuous sole plate of cast iron, and the larger plant is arranged to stand on a concrete foundation. The engines are compound and condensing, fitted with Jackson's patent valves for steam distribution. The air pump, condenser and feed pump are integral parts of the structure. There are now in these works, two other 44-inch pumps and engines in process, both of like arrangement with the one above described. We expect to give a further description and an illustration of these plants.

The *Marine Review*, Cleveland, Ohio, has, in these hard times, found ways and means to extend and embellish that enterprising journal in a way to cause envy. With No. 19, which should be

No. 253, there was issued four double-page sheets of photographs illustrating the new American trans-Atlantic line ship *St. Louis*, with some other notable vessels. The work is of the finest description. Next, in No. 20, which should be No. 254, we find a double number, containing a full report of the proceedings of the late meeting of the Society of Naval Architects and Marine Engineers at New York, also an account of the launch of the *St. Louis.* We have had occasion before this to note how the *Review* had made itself into a model journal, and predicted its success. Cleveland is a good place for success, and some time, not very long hence, is to be a great city, notable for manufactures and energy.

Mr. Robert Stevenson, C. E., of Glasgow, now residing in this State, who recently presented before the Technical Society a paper on "The Kinetic Stability of Bodies in Rapid Motion," is anxious that some of our learned institutions should try an experiment on the flight of a projectile in a vacuum to see if its trajectory followed the law of gravity, and the fall be according to the rule of acceleration. This could be done at no great expense, if the use of some large water pipes could be secured, the ends closed, and the air pumped out. Sheets of thin paper could be put in the joints so the projectile would pass through the paper and produce a true diagram of its flight. The purpose of a vacuum is to disprove or test the assumption that the continuance in a right line, of a shot for example, is due to atmospheric conditions. That a shot does not "fall" during the earlier portion of its flight has been proved by experiments in England and elsewhere, and it is natural that Mr. Stevenson should harmonize this with his theory of kinetic stability, and his opponents fall back upon "polarization of the atmosphere," whatever that may mean.

The Oakland Iron Works are to be rebuilt on a more extensive scale than before the fire there, and with improved provision for handling material and work. The machine shop will be 100 × 100 feet, divided into three "bays," each served by an overhead traveling crane to sustain fifteen tons, and by this latter arrangement of the cranes will save several thousand dollars a year in labor hire. We have seen a machine shop reached all over by light traveling cranes, where there were no laborers except to clean up. The men in charge of machine work, and fitting also, did not want any "lifters"

in their way, and preferred to handle their own work when the tackle was available, and that was always, because there were several light cranes in each bay. These cranes were very simple, and could be drawn quickly by hand to any point on the floor.

Messrs. W. T. Garratt & Co., of this City, are constructing a reclamation pumping plant to raise 30,000 gallons per minute against a head of 18 feet. There are two pumps of 24 inches bore, driven by triple-expanding condensing engines, to operate with a pressure of 140 pounds per inch. The boilers are of the marine type, 6 feet in diameter, 11 feet long, containing corrugated furnaces, 38 inches diameter, 8 feet long, each boiler having sixty-four return flues 3 inches diameter. This plant, on the score of economy, should exceed ordinary practice, and is guaranteed to operate with less than two pounds of coal per horse power per hour. The duty will require about 250 horse power. The machinery is to be erected near Rio Vista, on the Sacramento River. We hope to have an illustration of the plant for a future issue.

Geo. H. Roe, President of the Edison Light and Power Company, of this City, and the founder of the California Electric Light Company, and its manager previous to the succession of the Company first named, died in Brooklyn, New York, on the 10th of December. Mr. Roe was a Canadian by nativity, an example of tireless energy and high administrative ability. He came to San Francisco in 1876, and in 1879 organized electric lighting here, extending the system continually down to the present time, and expanding it to dimensions scarcely exceeded anywhere in the United States. Mr. Roe was of a nervous temperament, capable of intense thought and application. His work of five years past could have been reasonably expanded into a lifetime, and his death was, no doubt, due to causes arising out of a mental strain carried beyond his store of vitality. He will leave a wide circle of friends, among them the proprietors of INDUSTRY, which was founded at the suggestion of Mr. Roe and others in 1888.

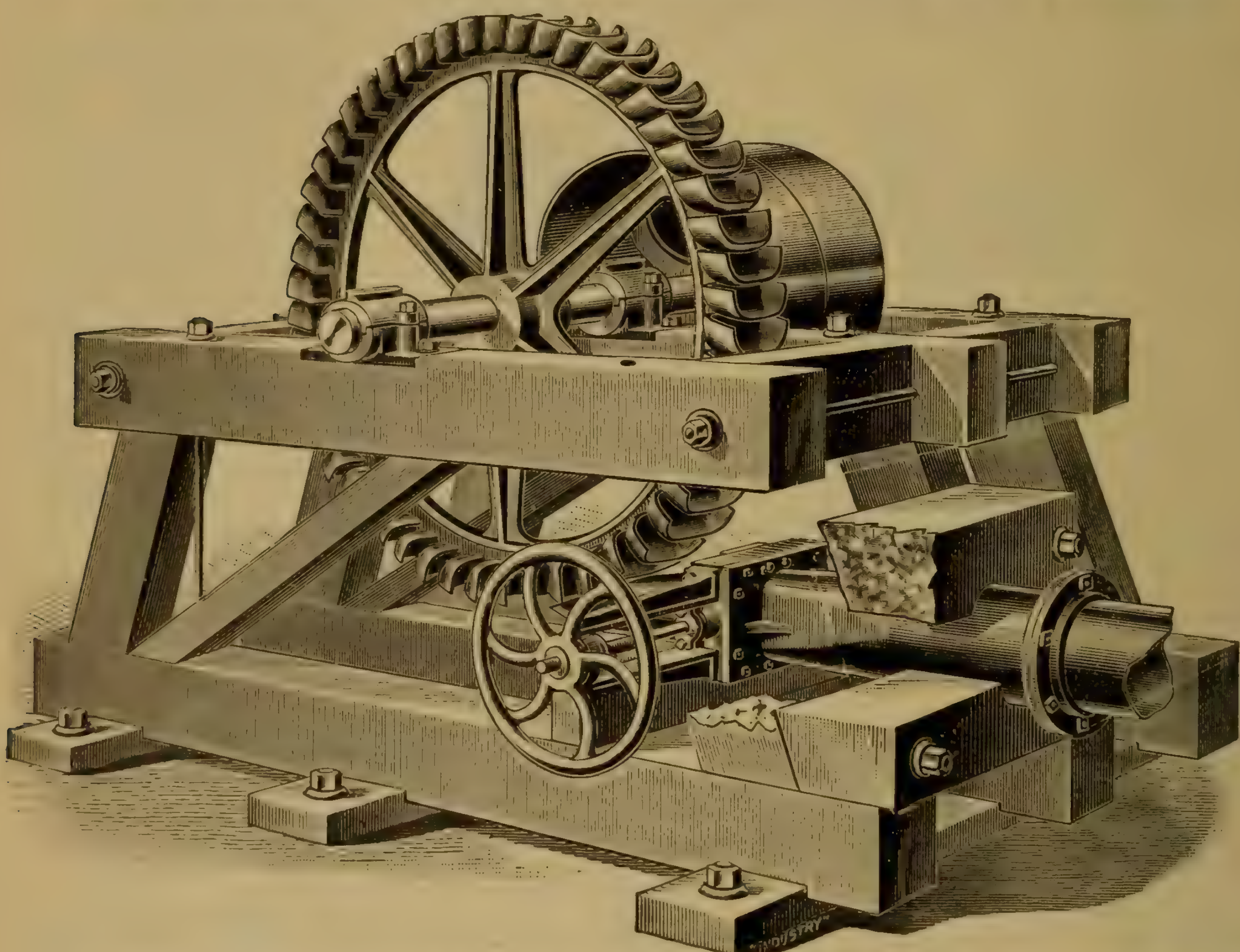
Comments.

Cassier's Magazine, for November, is the finest number issued for a long time past, and is replete with interesting and instructive matter. The biographical notice of John Ericsson, by Mr. Church, will be perused with much interest in this country, and anticipates a less pretentious article had in view for this Journal, and which may yet appear, as it will contain some additional facts. We have been over a good deal of the ground where Ericsson's first work was performed in Sweden, and by speaking the language have learned many things of a traditional kind respecting the great engineer and his brother Nils. Mr. Church adds to the merits of his well-written account of Ericsson by describing his love for his native land. This is a quality common to the Swedes, and is reciprocal. The mother country never forgets her children. The causes of this are a venerable and connected history full of great and worthy deeds, clear and authentic for a thousand years past, and a social system more nearly divested of selfishness than any other that can be compared with it.

The French steel makers have a hard time of it in competing with the Sheffield makers, especially Messrs. Jessop and Sons, for the finer grades of tool steel. Large orders are continually given to the English makers at an advance of 25 to 30 dollars a ton over the home price in France. Tool steel is an exceptional commodity to manufacture. Complete uniformity and homogenity are essential, and these qualities are contingent upon a care and expense required in few other manufactures, and no doubt owing in a great degree to the evolution of more than a century of experience. The firm of Messrs. Jessop is that old, and their efforts to maintain the quality of their product are proverbial. We have known a member of this firm to come to this country, many years ago, to investigate a fault charged against Jessop steel, by a small user in Ohio. The investiagtion must have cost the profits of many years in that case.

By examining the literature of profit sharing one may see a gradual trend toward independent and responsible work, or, in other words, away from profit sharing, in so far as that term implies a division of what is called profits. Any other disposition of this

THE
KNIGHT WATER WHEEL



The drawing above shows one of Knight's Standard Water Wheels, of which there are more than 350 in use in California alone. These wheels are made from 2 feet to 6 feet in diameter, from 10 to 1000 horse power, and adapted to all heads and to all purposes. Their first cost is less than one half as much as pressure turbines, and the expense of maintenance is not one fourth as much. Circulars with full description and particulars sent free.

KNIGHT & CO.

SUTTER CREEK, Amador County, Calif.

N. CLARK & SONS

MANUFACTURERS OF AND DEALERS IN

CAPS AND TOPS

FIRE BRICK AND FIRE CLAY

Water Pipe **Chimney Pipe**

17-19 SPEAR ST., · SAN FRANCISCO

great problem must be based upon honest accounts, or open accounts, and there is nothing in the ethics of modern business methods on which to found a system of profit sharing. When a man chooses a trade or calling he elects to stand by it, and live from its earnings. He has no equitable claim on another man's skill or capital, and does not want to be patronized. His own trade is good enough if it is set off, and its product not absorbed in profits to others. Labor and capital when separated can coöperate, but will not do so when combined, because combination is impossible on equal terms in what we call the skilled industries.

The following, which has been going the rounds of the press, is a fair example of a class of economic sophistry. The remark is attributed to Abraham Lincoln :

"When an American paid twenty dollars for steel to an English manufacturer, America had the steel and England had the twenty dollars. But when he paid twenty dollars for steel to an American manufacturer, America had both the steel and the twenty dollars. That was the sum and substance of the tariff question as he viewed it."

Of course Abraham Lincoln never made any such a remark, unless he was propounding a puzzle for his children. When an American pays twenty dollars for a ton of foreign steel (Lincoln would have said $100, the price in his time) the Americans would have had two tons of steel in the country instead of one, and if the imported steel was worth more than the gold paid for it there would have been a gain of that much. A ton of steel is an industrial commodity, and twenty dollars in gold is an implement, of no use to anybody except it can be converted into steel or something else. A simple equation is, however, too much for people who invent such catch phrases as the above.

The New York *Nation*, so far as observed, is alone in criticising the cold-blooded comments upon the war in Asia, pointing out how in all the essays, descriptions, and news even, there is scarcely a line deploring the lamentable destruction of life in the sanguinary encounters. From both the present and past Secretaries of the United States Navy has appeared serial literature of the bloodthirsty order. In speaking of the murderous circumstances of naval warfare they discuss these matters as a lot of medical students would the cutting up of a live dog or a hare. War is

stupid barbarism at best, and a logical answer to all theories of armaments and war power is that these things produce war and barbaric ideas. The only safe countries at this day are those without navies and armies, and as soon as either of these have attained sufficient size a war must follow, if for no other reason, to attempt by conquest to make some one else foot the bill. Bereft of all this machinery of barbarism our energies would be better and more profitably employed.

The people of this country are just beginning to realize that they have been "railroad crazy." They have put into such property all of their own money, and borrowed all that could be found in other parts of the world. The result is the "crash" that came last year, and far from done with at this time. This was done under the assumption that internal commerce alone was all that was required, and that a vigorous people could consume the whole of their own products. Hence foreign shipping was descried, and legislated out of existence. It is not ten years since a professor in the University of Pennsylvania asserted that foreign trade was undesirable and demoralizing. Now some little light is coming, the pinch of adversity causes people to stop and consider whether their country is not like other countries, and if their foreign commerce should be taxed twice, and nearly prohibited.

Eight years ago, when the Leary log raft was wrecked on the Atlantic Coast, on its way from Nova Scotia, we predicted a failure of the system, also claimed that if successful at sea there were a good many reasons that would prevent any permanent gain. People on the Eastern Coast have had enough of ocean rafting, and the same may now be said of the scheme here. The last venture of the kind, consisting of 10,000 logs, secured by 60 tons of chain, started out from Astoria, Oregon, in October, and is now scattered like "leaves of the forest," and is the second failure in six months past. There is no need of such rafts; there are ample carrying facilities now idle, to a great extent, and the success of a raft would do but little good in a general way, except to unsettle rates and be a speculation instead of a permanent improvement or economy in the timber trade. The last raft when completed was three feet above the water line, and this buoyancy is no doubt what destroyed it. The lower such a body is in the water the less strain it will have to withstand.

In some recent tenders for steel forgings, or steel for forgings, at the United States Armory, Springfield, Mass., it is said that a tender from the Krupp Works, at Essen, Prussia, for delivery free of duty, was 1¼ cents a pound higher than American firms tendering for the same material, so the tariff is not much of a factor in this line of production, and its absence in future would be more apt to keep up the American standard than a duty. It must be remembered too that the bid from Germany is most likely an unfair one, because the practice there for some time past, since the imposition of high duties, has been to add on the prices at home enough to permit competition with the English in foreign markets, in other words, deliver steel at cost to foreign buyers, and make the German people pay a profit on it to the makers. Just after the passage of Bismark's tariff law, ten or twelve years ago, steel rails were sold by German makers in Italy at $37 a ton, and to the German lines at $52 a ton, so it was stated at the time.

The Commissioner of Patents recommends that the old controversy in respect to the simultaneous expiration of patents with the shortest term in any country where the patent is taken out, be settled by allowing to American inventors the full term of their grant for the United States, irrespective of foreign patents. This would remove one objection of much importance; the limitation in all cases of an American patent taken out in foreign countries. In most cases such foreign patents are granted for fourteen years, and shorten all American patents three years. There are at least a dozen bills of one kind or another before Congress to tinker the patent laws, most of them without any useful or logical object, presented by Congressmen who have an "idea." The American patent laws are all right, or at least as perfect as in any country, baring the "rejection" of applications by the examiners.

Car wheels are being made at three quarters of a cent a pound, $4.50 for wheels weighing 600 pounds, and are the cheapest iron castings on record in this country. It seems only a little while ago when car wheels of this weight, or less weight, brought $26 to $30 apiece, and we doubt if anyone can make a good car wheel out of proper material for 75 cents per 100 pounds. The unnatural stimulus, due to a system of import duty, and the extraordinary demand for wheels owing indirectly to the same cause, has developed

a home competition, reducing prices below a reasonable standard, if not below cost. Changes in prices are a sign and cause of business retrogression, and whatever tends to change values is bad. No other country but this could stand the fluctuations in values that have occurred here, without being commercially ruined, and the main cause has been legislative interference in the affairs of trade and commerce. In 1878 and 1879, at the time of the greatest changes ever experienced, one of inflation, prices came near doubling in half a year, and the effect followed in 1886.

Mr. Carroll D. Wright, head of the United States Bureau of Labor, in a speech before the Union League Club, of Chicago, recently, went on to show that arbitration of labor disputes was impossible, but in reading his remarks one is reminded of the old adage of setting up a man of straw to be knocked down. The lecturer claimed that arbitrary settlement of labor disputes is impossible, a proposition no one will dispute, but when has there been any such method proposed? The very name in its common acceptance means just the opposite of an enforced or legal decree. Disputes are referred to disinterested persons, who render a decision which the disputants are not obliged to accept unless by prior agreement. In Sweden civil disputes of all kinds must be submitted to arbitration, but this does not prevent the contestants from afterwards proceeding with legal actions. To settle the terms of a labor dispute "by law" would produce a nice "kettle of fish." It is absurd, and, as Mr. Wright says, would be the same thing as setting a legal price on commodities, also that the law can compel a man to work. No one has thought of such a thing.

We have several times pointed out, how in the arrangement of customs, this Coast has been made to suffer very great wrongs. Taxes on coal, jute and tin, have borne heavily on the industries here, and now when there has been a reduction in the taxes on most imported commodities, there is a duty of 40 per cent. or so put on petroleum. The idea of importing petroleum into any other portion of the United States is preposterous, and the new tax is one for the Pacific Coast. The main cause of this is to favor the Standard Oil Company and the Southern Pacific Railway Company, by preventing the importation of oil from Peru, which had become a

CONTENTS.

SECTION I.—CONSTRUCTION AND OPERATION.

SECTION II.—HISTORY OF CENTRIFUGAL PUMPS.

SECTION III.—APPENDIX.

considerable trade, in the hands of Messrs. G. W. Grace & Co., of this City. Petroleum, or illuminating oil as it is called when refined, is a commodity consumed mainly by the poor, who cannot afford gas or electricity, and it is on the poor this tax will mainly fall. This provision in the late tariff act, was, it seems, brought about by the two corporations above named.

Sewage disposal moves slowly in this country, owning to a want of laws to govern the matter and to prevent the polution of streams and other waters. A very perfect plant has been devised and put into use at Chautauqua, New York, designed by Dr. W. B. Landerth, also in a few other places. It is not our purpose to describe them at this time, but to call attention to the discharge of sewage into the short streams that flow from the mountains to the sea on the California Coast. Streams that flow a long distance at a slow velocity are not easily poluted, that is, the water purifies itself before it flows far, but in our mountain streams that are short and flow at a rapid rate, they are ruined by dumping into them the sewage of towns along their banks. Nothing but the force of penalties will remedy this state of things, and the sooner there is a law protecting streams from polution the better. The necessity of such protection will, no doubt, become an issue here in California.

The stock argument against Government ownership of railways, is that the civil administration is too corrupt to manage such property. This is queer argument for men who claim to be patriotic, and that our Government is no worse than in other countries. If it is true that such a state of corruption exists, it is high time to have some other kind of a system. The Government manages the post-office, and except under two administrations, no imputation of corruption is remembered. The Internal Revenue, Patent-Office, Engineer Corps, Coast Survey, and indeed all bureaus of a non-political kind seem to be managed very well. It is not corruption that is feared, but an interference with corruption, and the chances of "manipulation" the railway system now permits; that is feared. The Credit Mobilier, Contract and Finance Company, Jay Gould's chicanery, the Northern Pacific operations of last year, and the Hocking Valley steal of this year, are the kinds of business that would be interfered with.

Mr. Marvin E. Sullivan, C. E., of Longmont, Colorado, has prepared a new formula to determine the flow of water in pipes, channels and otherwise, that seems to supply or substitute some factors in a manner to simplify problems of the kind, and has published an explanation that will have interest to engineers. Copies of the pamplet will be sent on applications from professional people. The Kütter and D'Arcy formulæ are more intricate, and shorter forms, like Etelwein and Hawkley's, are not much employed in this country. There is perhaps in all an element of uncertainty, because of the unknown co-efficient of roughness. This is provided for by a flexible system of constants, correct enough with new pipes, but a guess for pipes after long use, unless under scouring velocities or for very pure water. Mr. Sullivan's method of computation was set forth in a paper read before the Irrigation Congress at its last meeting.

The system of government in this country has many absurdities and antiquated ideas, and among them nothing more striking in its nature than "misrepresentation." In 1892 we had a meeting of Congress for Legislative purposes after the country had condemned in an emphatic manner the policy of that Congress. Now we have the same thing again, a Congress repudiated by popular vote, coming together to misrepresent popular opinion. Perhaps some one can explain why Congressmen are elected a year before they take their seats, and perhaps no one can. It is not necessary however, it would only lead to other questions equally hard to answer. The whole of the system is out of date, and out of keeping with a Nation of more than 60 millions of people. It did very well for a few colonies in a new country, composed of very honest people. It is now an anachronism.

Engineering Notes.

United States Naval Constructor A. W. Stahl, read at the late meeting of the Institute of Naval Architects and Marine Engineers, New York, a paper on "Hydraulic Power for War Ships," containing much new and interesting matter of fact, and what the physicians call "prognosis." The paper will have interest here, because of a large amount of technical information, accompanied by drawings, of the hydraulic apparatus on the war ships built at the Union Iron

Works, where Constructor Stahl was on duty for several years. The most notable point in Constructor Stahl's paper is his views on the employment of impulse water wheels for the distribution of power for various purposes on shipboard, as proposed by Mr. Geo. W. Dickie in his paper on the same subject read before the Engineering Congress, at Chicago last year. The present paper came too late for a more extended notice.

There is noticed in a number of exchanges a proposed plan of covering flywheels with paper to guard against their breaking by centrifugal force. A good many people will laugh at such a thing, but if they will take a strip of Manila, or any other strong paper, and hang weights upon it, noting what it will sustain, then compute the section of the paper by piling it up like a book, and counting the leaves or layers, it will be found that paper is a very strong substance. General Tilghman, of Philadelphia, once remarked that tissue paper could be made as strong as steel, and his remark was, no doubt, based upon experiment, because he is extremely conservative in his views. Paper, such as Molesworth's Pocket Book is printed on, piles 1,000 to an inch. One of these leaves will lift easily 5 pounds, consequently the book, 3 × .75 inches, will sustain a pull of 3,750 pounds, and this is only printing or book paper. The strength of Manila paper, and of other kinds, is, no doubt, known, and a paper hoop for flywheels may after all be a common-sense expedient.

The *St. Louis* and *St. Paul*, Atlantic line steamers, now being built in Philadelphia, for the International Navigation Company, are the compensating steamers for the *City of Paris* and *City of New York*, admitted to American register on condition that two steamers of equal size should be built in this country. The *St. Louis* has been launched, and the *St. Paul* is in a forward state. They are the first trans-Atlantic steamers built for twenty years past, and form the fifth and sixth ever built for this service; the others being the American line, the *Pennsylvania*, *Indiana*, *Ohio* and *Illinois*. The new steamers are 554 feet long, 63 feet beam, and of 11,000 tons. The engines are quadruple expanding, two sets in each vessel, making up 20,000 horse power. The cylinders are 36, 50, 71 and 100 inches diameter, 60 inches stroke. The boilers are 15 feet 7½ inches in diameter, double ended to furnish steam at a pressure of 200 pounds per inch.

Some of the private railways of Japan have sold a part of their English locomotives to the government, and purchased new ones in this country. American makers have a great advantage in design for locomotives adapted to other than perfect permanent way, and English makers seem to be unable to construct a type to meet these conditions, or rather cannot make two types. There is no doubt that the British engines are as nearly perfect as can be for service in that country and the best lines on the Continent of Europe, but these make up but a minor part of the whole, leaving for the American makers a wide field that has been followed up with more vigor than can be claimed for any other class of machinery made in this country. The distinctions in practice or design between American and European engines, has been the subject of copious controversy, useless too, because each are an adaptation to different conditions, hence are not directly comparable.

Recent estimates submitted for a bridge over the Hudson River, at New York, indicate that the suspension system has seen its day, even for long spans. A "cantilever" estimate was $22,000,000, with four years to construct, and the suspension plan was $35,000,000, requiring eight years to construct. The central span is to be 2,000 feet, or as much shorter no doubt as the Secretary of War will permit. The development of the cantilever system is modern, the arch, suspension and truss preceding. The arch is well understood, so also the suspension form and the trussed girder plan, but the cantilever is not so plain in its nature. It can be compared to long tapering beams, like that of a scale, balanced at the center and projecting each way; or a single beam, jutting out from some immovable support. A bracket projecting from a wall is an illustration, or two brackets projecting from two sides of a room and joined in the center, all possible weight being avoided by tapering the structure outward.

The Otto Gas Engine Works, at Philadelphia, have not suffered much by the hard times. Their orders cannot be filled with the present plant, and new buildings are to be added, one of them 65 × 175 feet, in itself a large factory. Marine types of engines for gasoline are now added to the list, the same engines being adapted for driving dynamos. The Otto Engine Works has been a most successful enterprise, founded about twenty-four years ago by Messrs.

Schleischer, Schumm & Co., from Deutz, in Germany, the home of Dr. Otto, to whom this great manufacture is indebted for its practical or commercial origin. The works, at Thirty-third and Walnut Streets, in Philadelphia, were built, as remarked, about twenty-four years ago, and were at the time very extensive and complete. The founders brought with them the idea of exact fitting, and for a time astonished even Philadelphia workmen at the standard set up. The great parent works at Deutz, opposite Cologne, on the Rhine, was, and is, no doubt, one of the most thoroughly organized in Europe.

Mr. James Howden, of Glasgow, who has been contending with marine water-tube boilers, has the courage of his convictions, and challenges the makers of the Belville type to enter a contest with Scotch cylindrical boilers of his make. His proposal is that the water-tube people shall provide boilers of 500 horse power, and use 400 indicated horse power on trial, with grate area of 59 feet, and heating surface of 2,380 feet, which we presume corresponds with their practice. Against these boilers he will place a single-end cylindrical one with two furnaces, having 1,336 feet of heating surface, or 1,044 feet less, and grate surface of 37.78 feet, or 20.22 feet less, or, in other works, these elements to be about one third less in the cylindrical boiler. The boilers to be tested at two trials of 30 hours each to determine water evaporated and horse power, one trial at 500 horse power and the other at 800 horse power. The boilers to be standard in all respects by Lloyd's rules, to work at 165 pounds pressure; total weight, space occupied, and evaporative power, and waste of heat to be taken into account. Mr. Howden proposes to work his boilers on his forced draught system, and give the water-tube boilers *20 per cent.* of a margin, and beat them; all expenses to be paid by the loosers. If this can be done it will call forth a large amount of new opinion.

"The battle of the boilers" is now "on," to use a slang expression of the day. In *Engineering* for Oct. 12, there were nine columns of small type devoted to the issue between shell and water tube boilers for marine service, and some astounding facts brought forward in the history of ships fitted with the different kind of boilers; it is too soon and perhaps unnecessary to make up an opinion at this time, because the war is not fully commenced. Messrs. Maudslay Sons and Field, who made the engines of the White Star

Steamer *Britannic*, now makers in England of the Belville water tube boilers, have recently issued a pamphlet, setting forth the performance of these boilers in the *Australian.* A correspondent points out the fact that the *Germanic*, built twenty years ago, and supplied with engines and boilers by the same firm, has steamed 1,250,000 miles, equal to fifty times around the world, and is now a first-class ship running at nearly 16 knots an hour, and develops more horse power per foot of grate surface than the new steamer with Belville boilers.

ELECTRICITY.

NOTES.

A new power plant to be erected for the West Chicago Railway Company, will be the largest one in the country. The plans include six engines of 2,000 horse power each, three of which will be erected at once. Fraser and Chalmers have the contract for supplying the steam engines and connected machinery, and the Siemans and Halske Company the dynamos, which are described as four machines, three of 1,500 kilowatt, and one 750 kilowatt capacity. The "watt" $\frac{1}{746}$ horse power, and the "kilo" or thousand watts, is therefore $\frac{1000}{746}$ or 1.34 horse power, roughly one and a third. The chimney is to be 240 feet high, 16 feet diameter inside, and 48 feet square at the base. The whole is to be ready at the end of January next, and, as said, is the largest yet provided for. These vast aggregations of power for street railway purposes, or for conveying people, have much significance in the devolopment of cities. It makes the central portion a business mart, and moves the population outside, also cuts up and spoils the streets, and arrays an interest against their improvement, but it is progress, or at least we call it so.

The Accumulator Company, of New York, have secured an injunction against the Edison Company, restraining them from using perforated grids or plates having active material in the perforations only, such construction being, as Judge Coxe decided, an infringement of the Swan patent, original number 312,599, of 1885; reissued No. 11,047, of 1889. This is bringing matters down fine, and the wonder is that the Brush patents do not anticipate Swan, or that Swan does not anticipate Brush. Whether it was the chloride

batteries that were involved we do not know, but their methods seem to lie within the distinction here set up, of a perforated plate having distinct or disconnected plugs of peroxide of lead in these perforations. The words of the Judge in his definition are "the confining of the material which was to do the work within perforations which extended completely through the plate." This is not very grammatical, or good technical language, and relates to a distinction which consists in fact in subdividing the active material into independent pieces or plugs.

If Mr. Saloni continues his investigations and discussion of electrical storage batteries people will before long come to an understanding of the economical points involved. We are, in this country, accused of neglecting the storage system, which is true, and because electricity is dealt with almost entirely by the companies who do not favor electrical storage. Engineers and architects do not take much part in the matter, and to a company supplying current there is no incentive for storing, on the contrary there is a loss of "returns." As it is now a person purchasing current has to buy in the case of small powers a good deal more than would answer under a storage system, especially where there are fluctuations in use, and must also depend on the central stations for running time. It is the same in lighting. With a storage battery the current is on tap, so to speak, day and night. The introduction of the accumulator system must come from people "outside," and will before long, no doubt.

Six years ago we ventured the prophecy that machine tools would soon be operated by independent electric motors. The advantage of the system was as well known then as it is now, but all this time has been required for evolution and adaptation of the motors to the different tools. Some clumsy attempts have failed where motors were set on shelves around the walls, and sometimes on the floor alongside the machines, to be stumbled over and broken, but when properly arranged as an integral part of original plans, and for the heavier class of tools, there have been no failures. The expense of the system is mainly in maintainance of the motors; any workman can take care of a countershaft and driving bands, but for the motors and electric connections an electrician is required. This has been the main impediment; another one was in adaptation by that inflexible body, the tool makers, who seldom change anything until compelled to do so.

The following notice of the "monocyclic" system of generators is taken from a foreign journal:

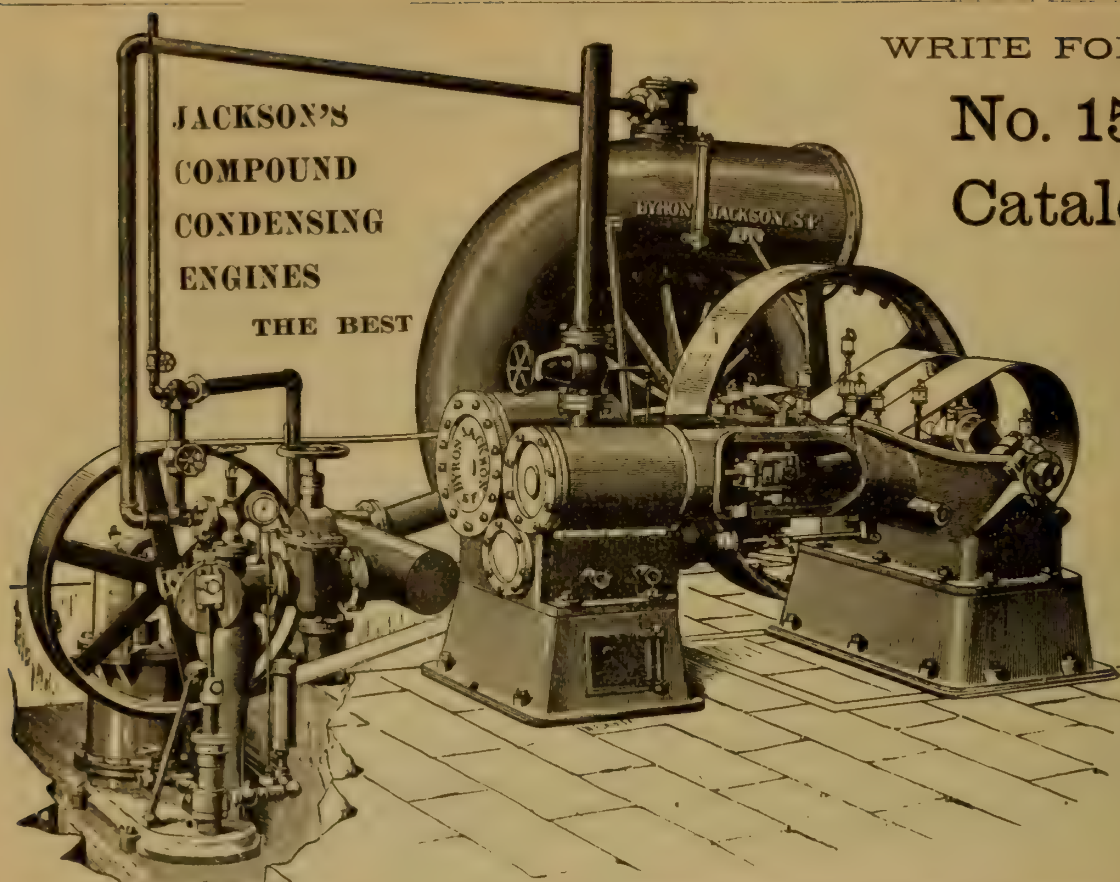
"A new title, though not a new system, is indicated by the monocyclic alternating system, which is being vigorously pushed in the States by the General Electric Company. The monocyclic denotes the low frequency single-phase alternating system, and it is considered to be the most promising innovation in the electrical power transmission field. It is used for lighting work, but by means of a balance wire, which is carried to the motors, is utilized for power at the same time. It is claimed to operate incandescent and arc lamps, and motors in parallel from the same generator, and even from the same transformer. The motors are claimed to be not only equal but even superior to continuous current motors in constancy of speed, great simplicity and absolute reliability—commutators, collector rings, brushes, or moving wires, being entirely absent."

In London they have had a "blow up" and serious accident from a conduit containing electric mains, by a leak and consequent ignition of gas in the conduit. It was raining at the time, and the water on the street surface was so charged as to kill a horse, and nearly kill several people who happened in the vicinity of the place. It seems there are leaks all over the gas system, and the conduits for electric wires become filled by percolation from the earth. The electric companies propose now to ventilate all their subways at a cost of $10,000. The cable that caused the accident by a break in the insulation was supplying 46,000 lamps. The ventilation of subways should be an easy matter where hollow columns or posts are employed, these if connecting with the conduit would act as flues.

MINING.

NOTES.

The greatest mining tunnel since the Sutro one at Virginia, has recently been completed at Park City, Utah, 15,490 feet, or nearly three miles long. It drains a number of mines, the Daley and the Ontario, at present. The tunnel taps the mines 1,500 feet below the surface, but in its course is at one point 2,500 feet below the surface or mountain top. The flow of water is stated to be 13,000 gallons a minute, but this is certainly more than the normal amount. The work consumed in all 75 months, so the rate was 6.75 feet a day. The cost of the tunnel was about $550,000, and it is estimated that

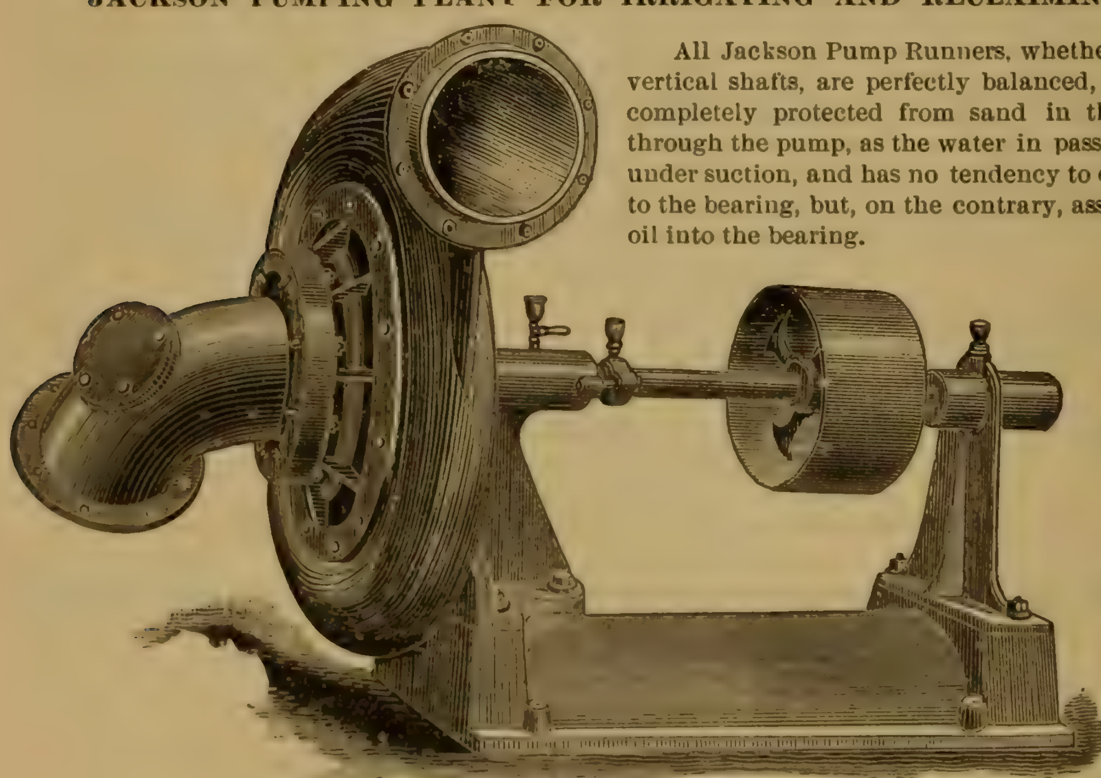


WRITE FOR

No. 15 Catalogue.

JACKSON PUMPING PLANT FOR IRRIGATING AND RECLAIMING LAND.

All Jackson Pump Runners, whether in horizontal or vertical shafts, are perfectly balanced, and the bearings completely protected from sand in the water passing through the pump, as the water in passing the bearing is under suction, and has no tendency to carry the sand into the bearing, but, on the contrary, assists in feeding the oil into the bearing.



JACKSON'S "WHIRLPOOL" CENTRIFUGAL PUMP

With cast sub-base, outboard bearing, and adjustable suction and discharge.

Byron Jackson Machine Works

— BUILDERS OF —

COMPOUND-CONDENSING ENGINES, AIR PUMPS

AND JET CONDENSERS.

Pumps for Irrigation and Reclamation, Dredging, Wrecking, Mining and City Water Works.

BOILERS AND ANY KIND OF MACHINERY BUILT TO ORDER.

625-631 SIXTH ST., SAN FRANCISCO, CAL.

the saving effected will be $250,000 a year. The two mines above named, raise 50 to 60 thousand tons a year. What was met with in this three miles of underground exploration, has not been reported, but it certainly affords a good deal of light upon the geology of the district.

Taken as a whole, the mining interests of California have never been in a more prosperous condition. Prosperity in mining as in farming, does not depend so much upon the amount of production as upon the manner of it. A diffused and permanent industry not disturbed by speculation and shifting values, is what is wanted, not the feverish spasmodic "good times," that tend to concentrate wealth. There is scarcely a mining district is this State that cannot report improvement and addition. On the Mother Lode alone is opportunity for all the capital and energy that San Francisco men can command; mines abandoned under the old system and new ones that can be opened under a promise of a fair return would consume millions and return millions, but the miner is so constituted that $15 per ton in Western Australia, is more attractive than $5 per ton in Amador County.

It is singular that so little attention is given to mining in Nicaragua. All authorities, as well as a considerable acquaintance with this country by old Californians, confirm the fact of a salubrious climate, even on the lower lands, and the existence of valuable mines is equally substantiated. A letter from Managua, written by Mr. J. Crawfords of that place, and published in the Bulletin of the Bureau of American Republics, indicates a field for gold mining that should command immediate attention here. Mr. Crawfords says that in the Princapulka district there are placer workings where men secure an ounce a day working with hand tools and rockers. The quartz mining is done in a crude way by hand implements, the ore pounded in mortars after picking, and that to be considered profitable it must contain $500 to the ton. There are, says he, abundant sources for water and power near enough to the mines, and the wonder is that more attention is not attracted to this country.

The *Mining Press* with vigor, and also with reason, condemns a reported negotiation of the La Grange Hydraulic Mines, in Trinity County, Cal., to a French syndicate for $5,000,000. There is some bond of sympathy that condones successful cheating in the sale of

mines. It is called sharp practice, shrewd dealing, successful scheming, and so on, but never low cheating. In such matters the community is held responsible for the individual's roguery, and the whole mining industry is indirectly taxed to make up the losses of duped purchasers. We do not know if the La Grange Mines are worth one million or five millions, but are quite sure they will not be offered for sale except at a great advance on their true value. A hydraulic mine with five millions of actual capital in it should earn a million a year, or over $80,000 a month clear, and this no one can predict with respect to a "hydraulic" mine, or even a group of them.

The *Engineering and Mining Journal* in a late issue, describes a new kind of stamp battery, erected at the Newton Mines, Idaho Springs, Colorado. The batteries have to operate on ores that require amalgamating in the batteries, also on other ores that require crushing only. This is provided for by adjusting the screens at different heigths, the copper plates supporting the screens for amalgamation, and the screens set below for plain crushing. As this does not seem to add much to the cost of a mortar and permits more free access to the interior, it is no doubt a good way to construct standard work of the kind, so as to adapt it to amalgamating or for concentration. The angle of inclination of the screens is made different on the two sides. There is of course the difficulty of adapting the stamps to both purposes, more depth and weight being required in amalgamating. The Newton mill has six of these batteries, of five stamps each.

The text of Justice Romers' London decision in the McArthur-Forrest cyanide process for gold extraction has now reached this country, and confirms the views of the *Engineering and Mining Journal* as to the want of novelty in the cyanide patents of McArthur and Forrest in so far as these cover or include the use of cyanide solution, that being not only known as a chemical agent for gold extraction, but also claimed in the older American patents of Rae and Simpson.

METRIC WEIGHTS AND MEASURES.

METRIC MEASURES OF LENGTH.

Millimeter ($\frac{1}{1000}$ meter)	equals	0.0394	inch.
Centimeter ($\frac{1}{100}$ meter)	"	0.3937	inch.
Decimeter ($\frac{1}{10}$ meter)	"	3.937	inches.
Meter	"	39.37	inches.
Decameter (10 meters)	"	393.7	inches.
Hectometer (100 meters)	"	328	feet 1 inch.
Kilometer (1,000 meters)	equals	0.62137	mile (3,280 feet 10 inches).
Myriameter (10,000 meters)	equals	6.2137	miles.

METRIC WEIGHTS.

Milligram ($\frac{1}{1000}$ gram)	equals	0.0154	grain.
Centigram ($\frac{1}{100}$ gram)	"	0.1543	grain.
Decigram ($\frac{1}{10}$ gram)	"	1.5432	grains.
Gram	"	15.432	grains.
Decagram (10 grams)	"	0.3527	ounce.
Hectogram (100 grams)	"	3.5274	ounces.
Kilogram (1,000 grams)	"	2.2046	pounds.
Myriagram (10,000 grams)	"	22.046	pounds.
Quintal (100,000 grams)	"	220.46	pounds.
Millier or tonnea — ton (1,000,000 grams)	"	2204.6	pounds.

METRIC DRY MEASURE.

Millimeter ($\frac{1}{1000}$ liter)	equals	0.061	cubic inch.
Centiliter ($\frac{1}{100}$ liter)	"	0.6102	cubic inch.
Deciliter ($\frac{1}{10}$ liter)	"	6.1022	cubic inches.
Liter	"	0.908	quart.
Decaliter (10 liters)	"	9.08	quarts.
Hectoliter (100 liters)	"	2.838	bushels.
Kiloliter (1,000 liters)	"	1.308	cubic yards.

METRIC LIQUID MEASURE.

Millimeter ($\frac{1}{1000}$ liter)	equals	0.27	fluid ounce.
Centiliter ($\frac{1}{100}$ liter)	"	0.338	fluid ounce.
Deciliter ($\frac{1}{10}$ liter)	"	0.845	gill.
Liter	"	1.0567	quarts.
Decaliter (10 liters)	"	2.6417	gallons.
Hectoliter (100 liters)	"	26.417	gallons.
Kiloliter (1000 liters)	"	264.17	gallons.

METRIC SURFACE MEASURES.

Centare (1 square meter)	equals	1,550	square inches.
Arc (100 square meters)	"	119.6	square yards.
Hectare (10,000 square meters)	"	2.471	acres.

No. 79. FEBRUARY, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

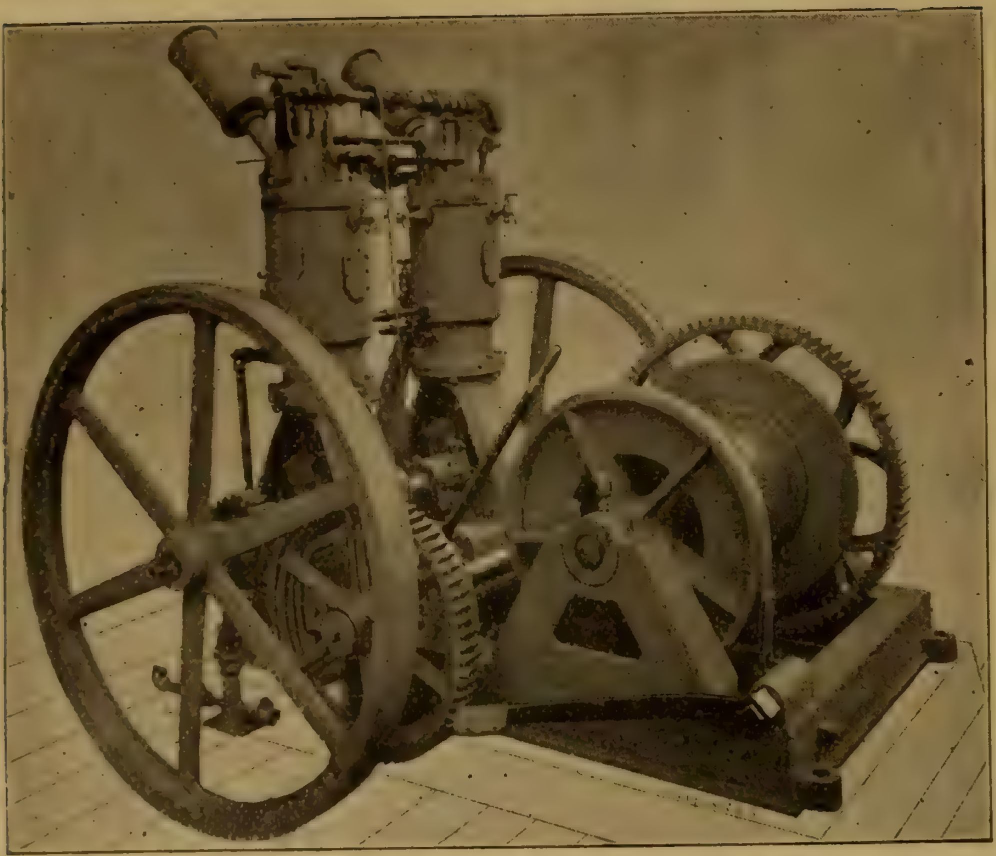
JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.



The "Golden Gate" Gas Engine

is not a new comer, but has not been advertised in the papers as some others, but if you are in need of a Gas Engine, just ask anyone who ever had anything to do with them, and they will tell you:

"Get the Golden Gate."

Uses Gas or Gasoline.

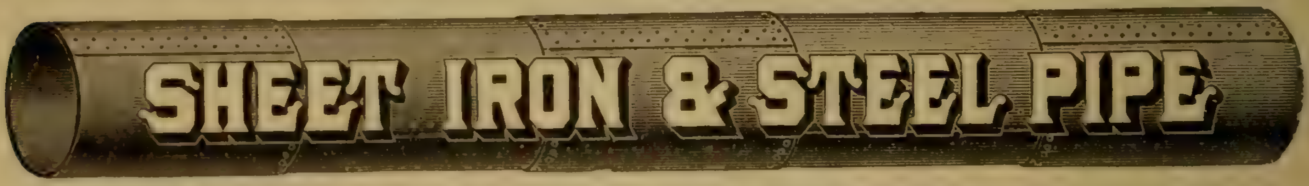
Made and Sold by

ADAM SCHILLING & SONS

211-213 Main Street, San Francisco.

The "GOLDEN GATE" is made strictly according to its own Letters Patent issued.

FRANCIS SMITH & CO.



130 BEALE STREET, SAN FRANCISCO

☞ Iron cut, punched and formed, for making pipe on ground where required. All kinds of Tools for making Pipe. Estimates given when required. Are prepared for coating all sizes of pipes with a composition of asphaltum.

SMITH & YOUNG

BUILDING SUPPLIES

230½ South Spring St., Los Angeles, Cal. | **723 Market St., S. F., Cal.**

Specialties.—Blue Print Paper; Casing Blocks; Deadening Felt; Infusorial Earth; Lamps, Buckeye Incandescent; Bostwick Steel Lathe; Marble; Mineral Wood; Mouldings, Turned Art; Paints, Plumbago and Malthine; Pecora Mortar Stains; Roofing; Sheathing Papers; Sash Balance and Lock, Combined; Shingle Stains; Soapstone; Spiral Balusters; Wood Carvings and Ornaments.

BY MAIL, 25 CENTS

THE GERMAN ROTE LEXICON

(SECOND EDITION)

German Translation Learned in One Month

An entirely new method. Commended by scholars and teachers. Assists but does not interfere with the regular course of study. 1,500 root words with prefixes and suffixes, prepositions, adverbs, conjunctions, declensions of articles and pronouns.

CENTRIFUGAL PUMPS

Construction, Operation, History and Examples.

BY JOHN RICHARDS.

TWENTY-THREE ILLUSTRTAIONS.

In Cloth Binding, postpaid.......... $1.00

INDUSTRIAL PUBLISHING CO.

40 California St., San Francisco.

"INDUSTRY."

JOHN RICHARDS, EDITOR.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

SAN FRANCISCO.

FOUNDED 1888. FEBRUARY, 1895. NO. 79

PRESSURE AND IMPULSE IN MOTIVE ENGINES.*

A LOOK INTO THE FUTURE.

When a man has spent thirty to forty years engaged in what is called constructive engineering work, in an advanced environment, with personal powers of discerning tendencies, and understands contemporary practice, he is then in position to render the highest possible service to the world by forecasting the future.

To do this to the best advantage he must withdraw from the activities of practice, and personal interest in a particular thing or branch, and must impartially survey the whole field, weighing, measuring, and comparing and considering what the trend is, and what the future will probably bring forth.

Such prognostication is of the very highest value. No other contribution to the world's industry can have more value, even in the intensely practical part. In fact, a great share of the highest human effort is devoted to prying into and endeavoring to find out what future wants will be, and what is likely to best supply these wants. It is the essence, so to speak, of both commerce and manufactures.

The most interesting and important part of such forecast relates to physical discovery in the technical arts, especially in implements,

*A paper read before the Technical Society of the Pacific Coast, by John Richards, Jan. 4, 1895. Reprinted by permission.

processes, and the control of natural elements, including motive power.

These remarks are suggested by a late letter received from Mr. Charles Brown, C. E., of Basel, Switzerland, containing some forecasts in respect to engineering matters.

Mr. Brown is one of the most eminent constructing engineers now living. This claim has authority far beyond the writer's opinions, but he can add the fact of for twenty years past watching with interest and profit every work and opinion emanating from this distinguished engineer. After a successful career of an average lifetime, in constructing work as diversified perhaps as has ever fallen to the lot of one engineer, bringing to bear thereon a remarkable natural ability coupled with education and training of the highest order, he has now turned back to look over the field passed through, and to draw from it conclusions that deal with the future.

I have no authority to introduce Mr. Brown's name here, and none to quote from his letters before referred to, but it seemed necessary in the present paper to shield myself behind the opinions of one whose views are entitled to much more weight than my own.

Some of Mr. Brown's views, as I gather them from one or two paragraphs in his last letter, and hinted at in previous communications of his, may be stated in the following propositions:

(1) The utilization of the force of fluids, elastic and non-elastic, will in the near future be mainly by impulse instead of pressure.

(2) The impulsion of fluids elastic and in-elastic, will be performed in future by the impulse of the same fluids, set in motion by rotation.

To render these propositions more plain, and connect them with familiar practice, they mean that steam engines, like water wheels and water engines, must abandon direct pressure and pistons for impulse wheels, and that piston pumps and blowing engines must give way to impulse apparatus.

This does not mean that a dynamic and constructive revolution is to take place, and that pumps and steam engines are to be at once changed from present methods of operation. No such proposition is intended, but that the future tendency is to be in that direction, or as we may say, is in that direction now, to a greater degree than is commonly known or supposed. The proposition must also exclude special appliances, both for elastic and non-elastic fluids, and be confined to what may be called common pumps and motors.

I am not quoting Mr. Brown's words, or paraphrasing them, but am to some extent guessing at his opinions by inference.

Before speaking of the subject in its practical aspect, and as connected with modern engineering practice, some generalization may render it more clear.

Machinery to utilize the gravity of water in descending from a higher to a lower level; machinery to overcome the gravity of water and raise it from a lower to a higher level; and machinery to utilize the expansive force of water converted to steam, or in other words, water wheels, steam engines, and pumping machinery, with their attendant elements, constitute a large share of what a mechanical engineer is called upon to study and deal with at this day, and it is to these the propositions before named relate. I will not detain you by statistics of the amount of steam and water power in the world, or its relation to transportation, travel, commerce, manufactures, and even the social conditions of our times. This is too well understood to call for remark.

In the descent of water we have the choice of two methods for utilizing its gravity—pressure and impulse. The first represented by water-pressure engines, gravity or overshot wheels, and pressure turbine wheels, such as those of Fourneyron, Jonval and the American types of inward discharge wheels, all operating by pressure caused by obstruction to flow, or, as we may say, receiving pressure directly. The second or impulse method, represented by the Atkins, Girard and Pelton wheels, operating from the impingement of jets set in motion by pressure, or, as we may say, by pressure in its second phase of spouting velocity.

The action of water in the case of enclosed or pressure turbines is not, I am aware, resolved mathematically, as stated above, but this rendering is near enough for the present purpose, which is to show how the two methods of pressure and impulse have in water-wheel practice been contending for thirty-five years past, dating from the first impulse wheels made by Messrs. Escher, Wyss & Co., of Zurich, Switzerland, about the year 1860. The principal facts of this rivalry will be again referred to.

In steam engines a similar struggle has begun between impulse and pressure. It is young yet, and lacks the history of water-wheel practice, but the future problem is now well before us in both its theoretical and practical aspects, but has not advanced to a place in popular knowledge that permits general discussion.

At this time all popular ideas, as well as nearly all practice, is confined to pressure steam engines of both the piston, or reciprocating, and the rotary kind, mainly the former, but all operating by direct pressure, and maintaining steam-close running joints, as around pistons. The construction and mode of operation is too familiar to require explanation.

In the other class of steam engines, the impulse kind, there is employed the efflux of steam impinging against vanes that move at about .055 of the velocity of the steam, or thereabout; for an average 500 feet per second, or 30,000 feet per minute, according to the steam pressure employed. In some cases discharged on the vanes at the initial or boiler pressure, in other cases expanded before impingement, down to atmospheric pressure, the effect being nearly the same, and as the mass, or ponderable weight of the fluid. The velocity is not diminished, and is even increased, at this lower pressure by means we need not inquire into here.

Here we have a strange analogy between the application of elastic and inelastic fluids, between water and steam, and in a change from pressure to impulse action. The same laws apply in respect to the relative velocity of motors, the method of application is nearly the same; in fact, impulse water wheels have in some cases been driven by steam.

The main distinction is in the respective velocities of efflux and consequent speed of the motors. For water we have $V = \sqrt{2 g H}$, and for steam $V = 60 \sqrt{T + 460}$, both in feet per second, or comparing for a pressure of 100 pounds to an inch as eight to one. At this pressure a steam-driven wheel to operate economically would have to attain, as before remarked, a speed of about 500 feet per second, more than 5.5 miles a minute.

Before referring to the tendencies in present practice, and considering what the future may bring forth, I will point out that a first conclusion will be that all these things are amenable to computation, and can be solved mathematically. This is unfortunately not the case. Some of the conditions, and even the dynamic results, may be thus arrived at, and have been in the case of Parson's impulse steam engines, also Dr. De Laval's, but the main problems are of a constructive nature, pertaining to the maintenance of high velocities, balancing, lubrication and the elements of transmission.

Still it must be admitted that but little progress can be made without the aid of computation in verifying and explaining results in so far as forces and resistances, but, as remarked, the chief

problem lies in that branch of engineering we call constructive. For example, a theoretical steam engine would be one of the rotary type, sustaining direct pressure, and moving at velocities not at all attainable in such engines, even if they were a possible machine on other grounds, which they are not.

The strange proportions of parts would never have been resolved as they are found in practice either by inference or computation, but being found, then new light is added by theory; definite rules are arrived at, the direction and measure of inherent forces are made plain, the thermal conditions are explained, but first and mainly must come the constructive idea or design qualified by working conditions so obscure as to defy human wisdom until tentatively developed by long and tedious experiments, dealt with empirically, often blindly, and no small share arrived at by accident. This has been the common course in the past, and is now to a great extent the course followed, but in some instances progress has been the other way, not from construction, use and experiment, but in attempting to supply mechanism to accomplish certain computed results.

Pressure and impulse steam engines furnish two notable examples of these two methods of development. The first were a constructive and experimental problem throughout three fourths of their history, before the study of thermal laws became a part of steam engineering. Then by both computation and a higher constructive skill the advance during twenty years past has produced our modern types, approaching nearly to ultimate efficiency for the pressure system as it now exists. The course of impulse-engine development is different. It starts with all the aids that have attended the final work on pressure engines, and on the whole the system or method has in ten years made nearly as much progress as the pressure or piston type did in a century; that is, from a steam consumption of 48 pounds per horse power down to 14.5 pounds, or high efficiency for a modern expanding engine of the piston type. This matter is mentioned as one factor to be taken into account in forecasting the future and interpreting signs that increase from month to month.

Reverting now to the practical part, and first to water wheels, we can easily follow the advance made in the impulse type. The first discovery and proposition of this method, so far as I can trace it, originated with Mr. Jearum Atkins, an American, now in his old age an inmate of the Mechanics' Home, in Philadelphia. He pre-

sented his invention of open or impulse turbine wheels in the American Patent Office in 1853, where it could not be understood, and a patent was refused. He at that time filed in the office a complete analysis of the theory upon which these wheels operate, clear, concise, and today one of the most lucid descriptions that can be referred to.

In 1875, twenty-two years later, a patent was granted to him for the same invention; but before this time, about 1860, impulse turbine wheels had been taken up by some of the foremost engineers in Europe, and had become a standard type in France and Switzerland. At the present time, and for fifteen years past, no other form of water wheels have been thought of there, or in other European countries, for heads exceeding fifty feet.

The practice is very uniform all over Europe, and the number of impulse wheels made must exceed pressure turbines three to one. The great wheels at Niagara are a modification of the Girard or impulse system, more nearly impulse than pressure wheels, the plans being supplied by Messrs. Faesch & Picard, of Geneva, Switzerland, who were among the early makers of Girard wheels.

On this Coast I need hardly say that tangential wheels, a purely impulse type, have displaced pressure turbines for all except low heads, with gain in efficiency, a saving in first cost and in maintenance. The impulse method has in fact been successful in all cases of competition up to a limitation by the volume of water that for constructive reasons renders the system inapplicable for low heads, and when wheels require to be submerged.

The change from pressure to impulse in water wheels is, however, by no means so great a change as that between pressure and impulse steam engines. The initial velocity of water, or of wheels driven by this element, is the same in both cases, but with steam the initial velocity is changed, as we have seen, as fifty or sixty to one, giving rise to new and extraordinary differences. To make these more plain I will again enumerate with more detail the conditions of operating with pressure or piston engines.

The weight and space occupied by motive engines of all kinds are, as a rule, inversely as the velocity of the "actuating parts," and by such a rule pressure engines should be fifty times the weight of impulse engines. The running joints or bearings for pistons, valve rods, valves, guides, connections, and so on, consuming from six to ten per cent. of the developed power in piston engines, are nearly avoided in the impulse type, but are to some extent, not

known, balanced with losses by air friction on the impulse wheels. The elements of transmission between the piston and crank shaft have at all points throughout to withstand the full measure of strain imparted to the crank pin, not uniformly but in a series of waves, to so call it, consequently these elements are about five times as heavy and expensive as when the initial movement corresponds to .055 that of the flow of steam, or is eight times greater. The change also simplifies such gearing.

Vibration, due to intermittent stress and reciprocating parts, is a serious objection and impediment in the pressure system. It calls for ponderous fastenings and foundations that with lavish plans and material, especially in vessels, is only partially successful.

Fly wheels have to be provided to equalize the variable turning moments in all land engines. This function is supplied in vessels by paddle wheels, screws and multiple engines, but a fly wheel of some kind is an essential part of an ordinary piston engine.

We have then in this case a motor moving at eight to ten feet a second, impelled by a fluid whose normal flow is eight to nine hundred feet a second; fifty times the weight, and ten times the space occupied that would be required if the steam could be directly applied. There is, however, one difference that must be kept in mind, that in engines driven by the impulse of steam a certain speed must be maintained, while in piston engines this is variable in any degree.

For most purposes this latter feature is not important, but is indispensable for traction, and we need not look for change in that branch of steam machinery. The same fault would in some degree apply in navigation where variable speed is necessary, as in the case of boats making frequent landings, but not for ocean service.

This difficulty in impulse engines arises from the fact that the flow of steam follows a different law from that of liquids, and is computed as a function of temperature, instead of pressure or head, varying only 35 feet a second between 25 and 100 pounds pressure, and only 10 feet a second between 100 and 150 pounds per inch, consequently speed cannot be controlled by volume.

But outside of all uses requiring variable speed there is left a much wider field for impulse engines, and considering the objections to the pressure or piston system before pointed out, we cannot wonder that men learned in these matters should set about finding out some escape from such sacrifices made to mechanical expediency. I am not able to name but a few of the eminent engineers who

have considered and are engaged in developing the impulse system for steam engines.

First may be named Dr. De Laval, of Stockholm, Sweden, inventor of the centrifugal cream separators, who to impel these high-speed machines conceived the idea of a steam-driven impulse wheel, operating by the direct efflux of a jet applied on vanes. This, as we believe, was about ten years ago. The object was not efficiency or novelty, but a high initial rate of rotation to avoid transmission gearing. The result was so remarkable as to lead on to further experiments and results until a steam consumption as low as forty pounds per horse power per hour was attained.

Then the matter began to attract attention, and the Hon. C. A. Parsons began, in England, a series of exhaustive experiments, connected with careful computations of the thermal and dynamic conditions attending on the impulse method, and now at the end of less than ten years he has removed modern compound piston steam engines in the city of London, and replaced them with steam turbines or impulse engines. This was done in one of the stations erected only a short time ago, and, as Mr. Brown remarks in his letter before referred to, "is a most significant fact." It is more than a year since the editor of *Engineering*, a high authority, conceded that the impulse steam engine had attained the same efficiency as a two-cylinder compound piston engine.

Able engineers all over Europe have this problem in hand now, and if, as Mr. Brown writes, steam consumption has been reduced to 6.5 kilograms, or 14.3 pounds per horse power per hour, the thermal problem is done, that is, the efficiency has overtaken the pressure engine, and now remains a development of various constructive problems that are almost sure to be rapidly worked out.

The speed of impulse engines follows the same law that applies to all motors driven by the efflux of fluids, the residual velocity, or, as we may say, the residual "rest," because there should be no velocity in the spent steam, is a resultant of two components, the movement of the fluid and that of the motor, the former being reversed in its course, and the relative speeds of the steam and the vanes or buckets being as 100 to 55. This rule produced in the first engines of De Laval and Parsons from 20,000 to 30,000 revolutions per minute. Five years of constructive effort has reduced these enormous velocities of rotation to one third as much, and to a point where direct connection to the armatures of electrical dynamos is pos-

sible, and the required gearing of transmission is brought well within the resources of modern practice.

The conditions of operation in pressure or piston engines have been in part pointed out, and, as said, disclose the incentives that have led to the impulse method. Ultimate efficiency is not the object. This cannot in the nature of things vary much between pressure and impulse. The force of efflux in fluids is equal to their gravity multiplied into their velocity, less the friction of orifices, and apparatus that will utilize the impinging force in the same degree that pressure is utilized by pistons will be equally efficient, other things being equal, so the objects to be attained by the impulse method for steam engines lies in another direction.

It will be revolutionary to institute complete comparison, and unfair in the present state of the impulse method, only ten years old, dating from the De Laval experiments. Steam consumption has fallen from 48 pounds to 14.5 pounds in that time, and from being a curious experiment the impulse engine has thrust itself in among its venerable competitors, not in obscure corners, but in high places. The electrical generators on the two greatest trans-Atlantic steamers, are driven by impulse engines, supplied by Mr. Parsons about four years ago. There are many other cases that cannot be called to mind at this time.

Other inventions of equal extent rise in these times, pass into the industrial field and soon disappear in the whirl of progress and change, that characterizes our age and time, but here is one of different nature and portent.

The application of motive fluids by impulse instead of direct pressure, that came about almost insensibly in water, means a wide revolution in steam, one that will not only modify constructively and economically nearly all that pertains to steam power, but will widen the field of application to hundreds of purposes, not now thought of.

Mr. Brown informs me that he is considering the application of impulse engines to traction purposes, but has naturally met with the impediment of variable speed, almost the only fundamental virtue inherent in the piston engine, and, as before said, confined mainly to this very case, so that he has attacked the exaggerated end of the problem, and will most likely abandon the scheme.

One other feature of impulse engines remains to be noticed. Expansion to the fullest degree must be a characteristic of any economical steam engine. This, Mr. Parsons provided for at first

in nine stages, and to transfer from one stage to the next, involved a principal feature of objection to pressure engines, that of maintaining steam-tight running joints, not actual contact between surfaces in this case, but joints of such precision that while not in contact, no considerable leak could pass through them.

This calls for an accuracy of work that cannot be attained with ordinary implements and by ordinary skill, but the De Laval engine avoids all this by a single application of the steam, first expanding it to the pressure of the atmosphere, and converting the expansive force into velocity.

This is in my opinion the key note to the whole system, because engines thus made require no close running joints, and are simple in all their elements, down to the reducing gearing, and this, as now constructed, seems to operate without difficulty.

For eight years I have urged on all possible occasions the attention of engineers on this Coast to impulse steam engines, and their importance for special, if not general purposes. These propositions have been treated, like perhaps the present paper may be, as a visionary matter, but, however this may turn out, I am getting into very respectable company, and feel encouraged accordingly, hoping even to see at some future time an engine of 100 horse power wheeled on a hand barrow, a quiet undemonstrative little machine that can be set in some corner out of the way on a common floor; also to see power distributed by impulse air engines over wide districts without much loss in transmission, without heat, danger, or the complication of electrical apparatus even.

This is, perhaps, enough for one occasion, all that it is safe to say, but having the floor I may as well go on and shock the engineering proprieties with the second proposition relating to impulse, laid down at the beginning. It was as follows:

"The impulsion of fluids, elastic and non-elastic, will in future "be performed by impulse derived from the momentum of rotation."

This proposition, almost wholly new to me, comes in a rough pen sketch and some explanation by Mr. Brown, of what he calls the centrifugal pump of the late Emile Bourdon, an engineer whose name will be familiar to most of those present by reason of his other inventions relating to fluid action.

Fourteen years ago, when I undertook the construction of centrifugal pumps here in San Francisco, I was informed by people whose opinions were certainly to be considered, that pumps of that kind would not operate against heads exceeding forty feet, and they

proved it too by rules, showing that an increase of resistances with head, fixed a commercial, if not practicable, limit at that pressure. Combining two pumps I found their force in series was multiplied accordingly, and a pump to operate against a head of eighty feet was made and operated successfully.

Single pumps have since then been made to raise water 160 feet without encountering the theoretical resistances commonly set forth in authorities, and I have the boldness to believe that the theories applied to these pnmps are wrong, and that what we call the centrifugal method of pumping has no such limits as have been fixed by computation. I presented in a previous paper before this Society the enormous increase of capacity, and a corresponding decrease in cost, of continuous flow pumps, and came near some predictions that if the paper were to be written now would form a portion of it.

Heretofore we have operated in one line of construction, or method, for generating what we call centrifugal force, or a force derived by rotation for impelling fluids, but if instead of centrifugal force we consider the momentum of revolution, and deliver this momentum impulsively to the performance of work, we are carried into a new field, and the limitations of centrifugal pumping will disappear, theoretically at least.

If a body of water is set in revolution by being dragged over large frictional areas by an impeller whose velocity at different radii cannot conform to that of the water, we cannot expect to impart to the water a very large proportion of the original energy, or driving power, employed to set the water in motion, but if the water is gradually set in rotation, almost without friction or retarding influence, except its inertia, that water applied impulsively should give out again in useful effect within a few per cent. of the original energy or power. To do this the water should not be whirled around in a stationary vessel or case, but in one revolving at the rate desired for the water to attain, and the impulsive effect taken off, so to speak, by impingement on the fluid to be raised or impelled.

It is, perhaps, inexpedient and unfair to bring to the Society's notice a matter so little supported by tangible data at this time, but knowing that some of our members are now engaged in hydraulic problems, relating to the impulsion of fluids without the losses of intermittent motion, and as the Bourdon pump is an impulse machine it cannot be passed by. The proposition involves both the

generation and application of the pumping or impelling force, and there is, of course, no direct analogy to steam engines and water wheels that draw from an accumulated store of energy.

The Bourdon scheme involves a translation, it may be called, of the energy as well as its application by impulsive effect.

Suppose that a cylindrical vessel like a centrifugal drying machine, having inward projecting vanes around its interior periphery, is filled with water, and set in revolution up to a velocity of 80 feet per second at the interior tips of the vanes. The water would then be moving at a rate the same as that produced by a head of 100 feet, and if this water could be diverted tangentially, and directly applied to the propulsion of other water to be raised or impelled, the losses would be inconsiderable. To take off this revolving water tangentially a discharge nozzle has to be introduced inside of the revolving chamber. This discharge pipe would, of course, obstruct or prevent rotation of the water in the zone occupied, creating a frictional area equal to the width of the revolving chamber multiplied by a circle touching the end of the discharge pipe. This frictional area is not more than a third what is encountered in a common centrifugal pump, and is that of viscosity principally.

This indicates in words the experiments being tried by Mr. Brown, who, as I understand, proposes velocities far beyond precedent, or possible, with a common centrifugal pump. The same method can be applied to air or any elastic fluid the same as water.

There may be present members who are familiar with the experiments and views of M. Bourdon. I will not pursue the matter further now, but with consent may at some future time lay before the Society some results of experiments now going on that may modify present views of the impulse method of translating energy.

CONSTRUCTIVE ENGINEERING ON THE PACIFIC COAST.

No. III.

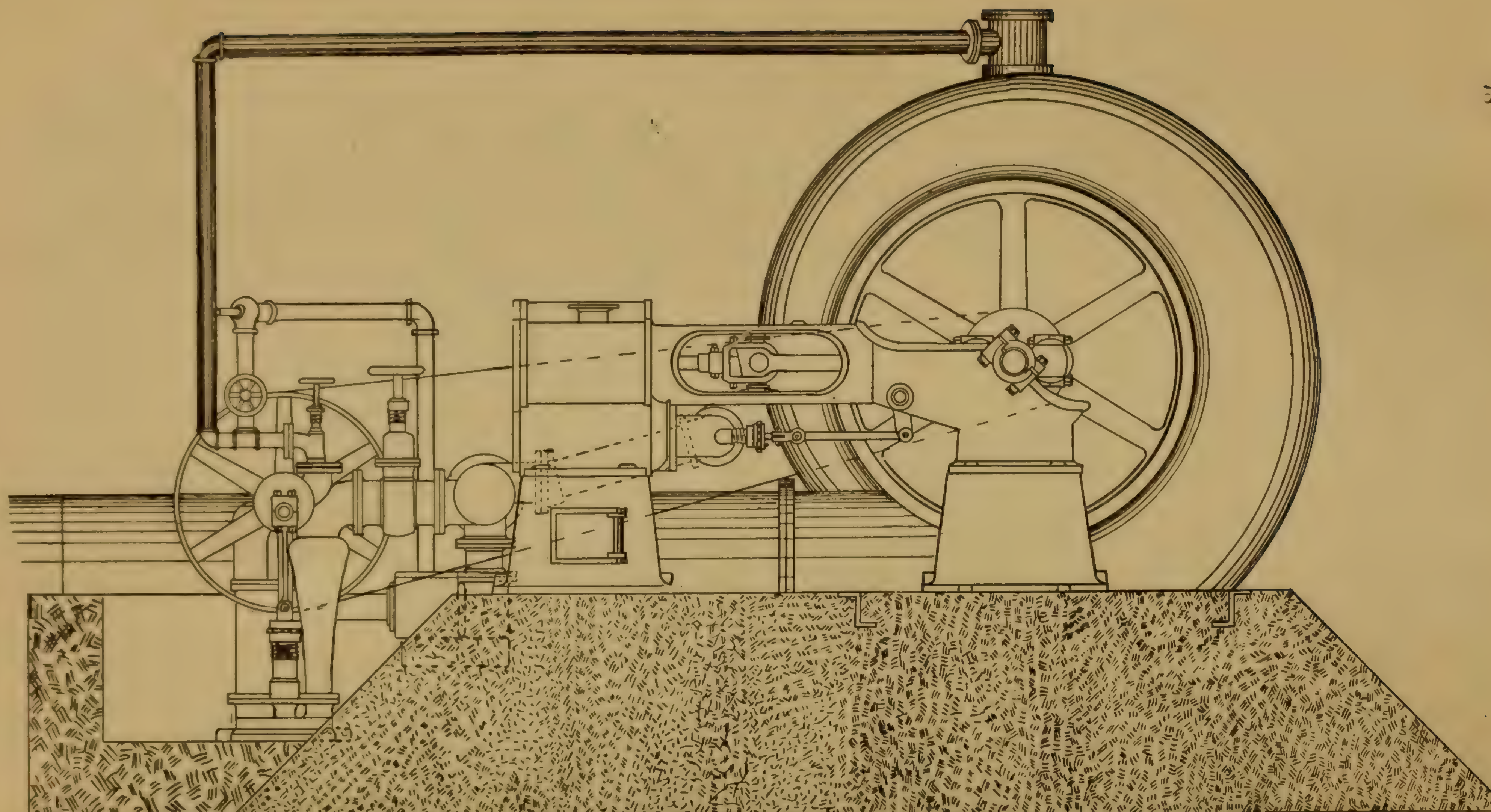
DRAINING MACHINERY.

In estimating the constructive skill, adaptation, efficiency, and other features of present practice in draining or reclamation machinery on the Pacific Coast, there are a good many local and peculiar circumstances to be taken into account. These circumstances are the variable amount of water to be raised owing to irregularity of rainfall, the changes in dikes and the course of streams, deflected from side to side by retaining works, or, as it may be called, the exigencies to be provided for in the capacity of such plants, and provisions to preserve the machinery from floods, the extent of which can only be conjectured.

There is, besides, changes of level produced by the volume of debris washed down by torrential streams, changes that would require a century on the Atlantic Coast take place here in a few years, or months even. There is now nine feet of water, and steamboat channels, over lands along the Sacramento River that were cultivated sixteen years ago. The country is new, in a geological sense, just being made up, so to speak, and subject to errosive action by water that renders reclamation plants temporary expedients compared to similar works in Europe and elsewhere.

This fact determines to a great extent the nature of the machinery and its foundations. A draining works erected in Holland, Denmark, or in the English Fens, is a work for ages to come. It may be capitalized on its earnings for a generation to come, or longer, but this is not the case in the great valleys of California. There is, therefore, an enforced economy of investment on one side, an enforced efficiency owing to the high price of fuel on the other side, an uncertain duty to perform, and, as before said, an uncertain tenure of existence owing to hydrographic changes, so the engineer must work between narrow lines, keeping in view limitations that do not exist elsewhere.

Not only this, there was sandwiched in between the Pacific Coast and the practice in Europe the very imperfect apparatus made in the Eastern States. In 1884 when large pumps were required for draining the Goverment graving docks, at Mare Island Navy Yard, the Eastern tenders for such pumps were so bad that the Union

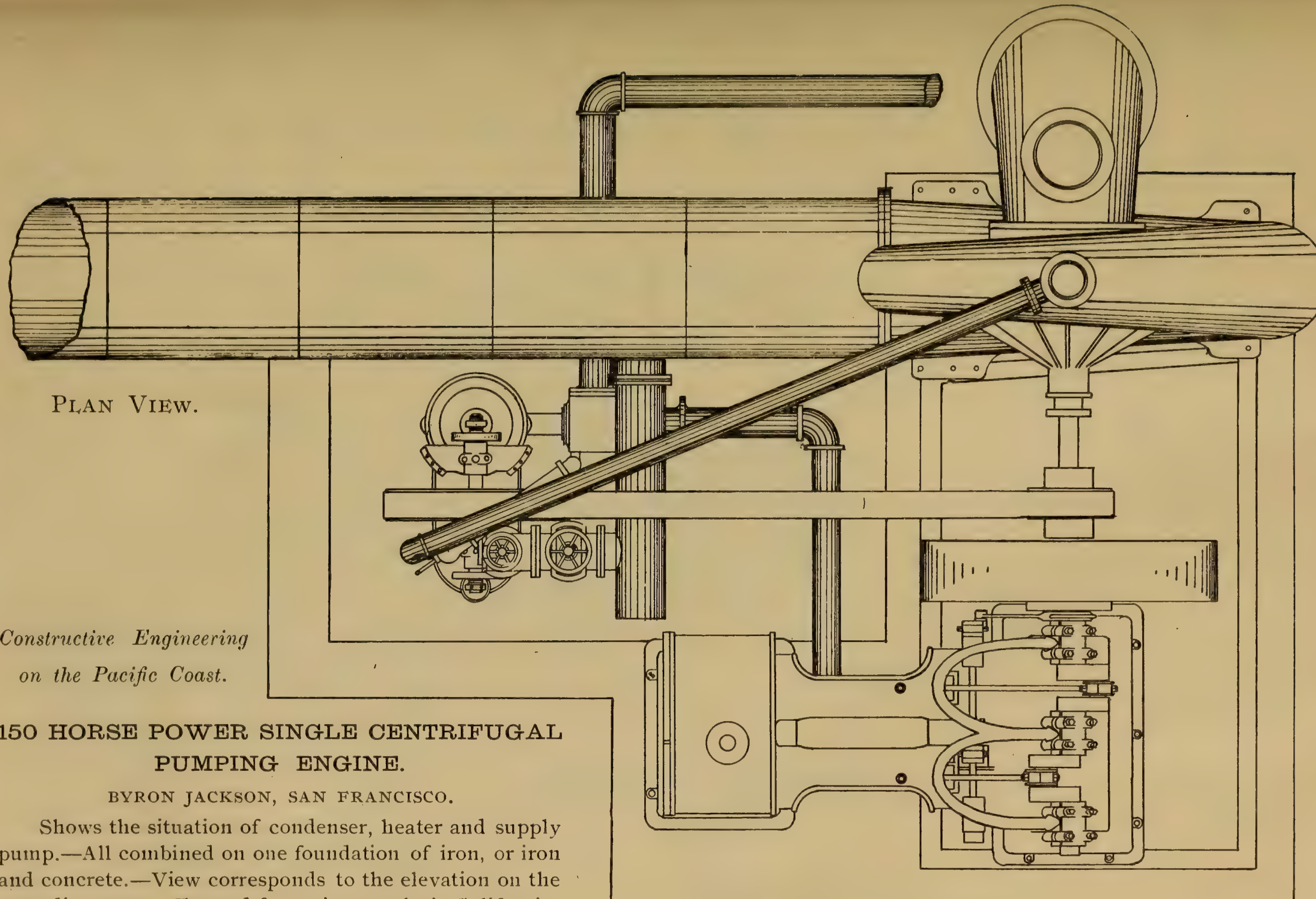


Constructive Engineering on the Pacific Coast.

150 HORSE POWER SINGLE CENTRIFUGAL PUMPING ENGINE.

BYRON JACKSON, SAN FRANCISCO.

Engine compound condensing.— Pumps 30 in. to 44 in. bore.— Capacity, 30,000 to 40,000 gallons per minute.— Single suction pipe on the opposite side.— Combined in pairs of double capacity, or single as above.



PLAN VIEW.

Constructive Engineering on the Pacific Coast.

150 HORSE POWER SINGLE CENTRIFUGAL PUMPING ENGINE.

BYRON JACKSON, SAN FRANCISCO.

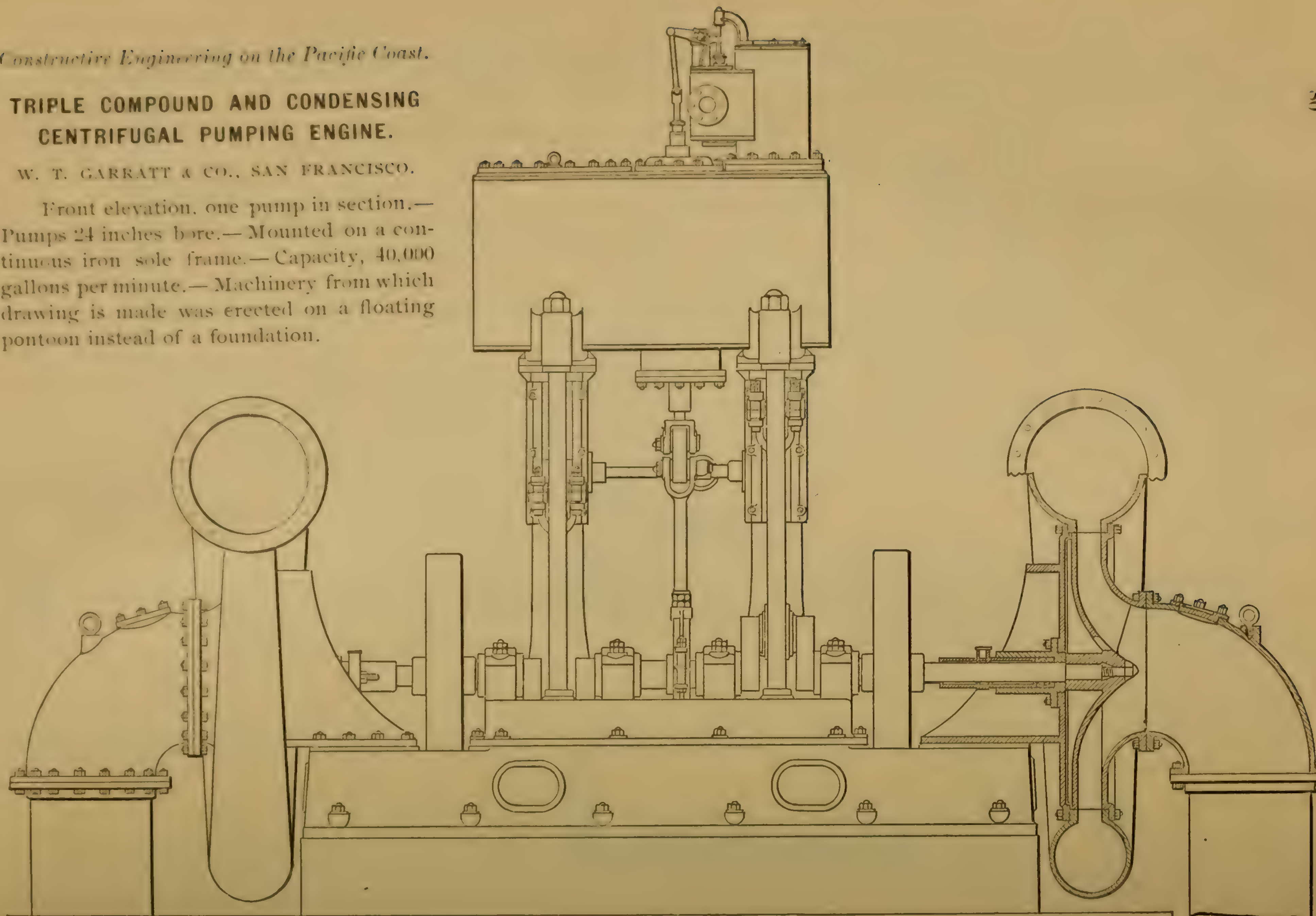
Shows the situation of condenser, heater and supply pump.—All combined on one foundation of iron, or iron and concrete.—View corresponds to the elevation on the preceding page.—Erected for various works in California.

Constructive Engineering on the Pacific Coast.

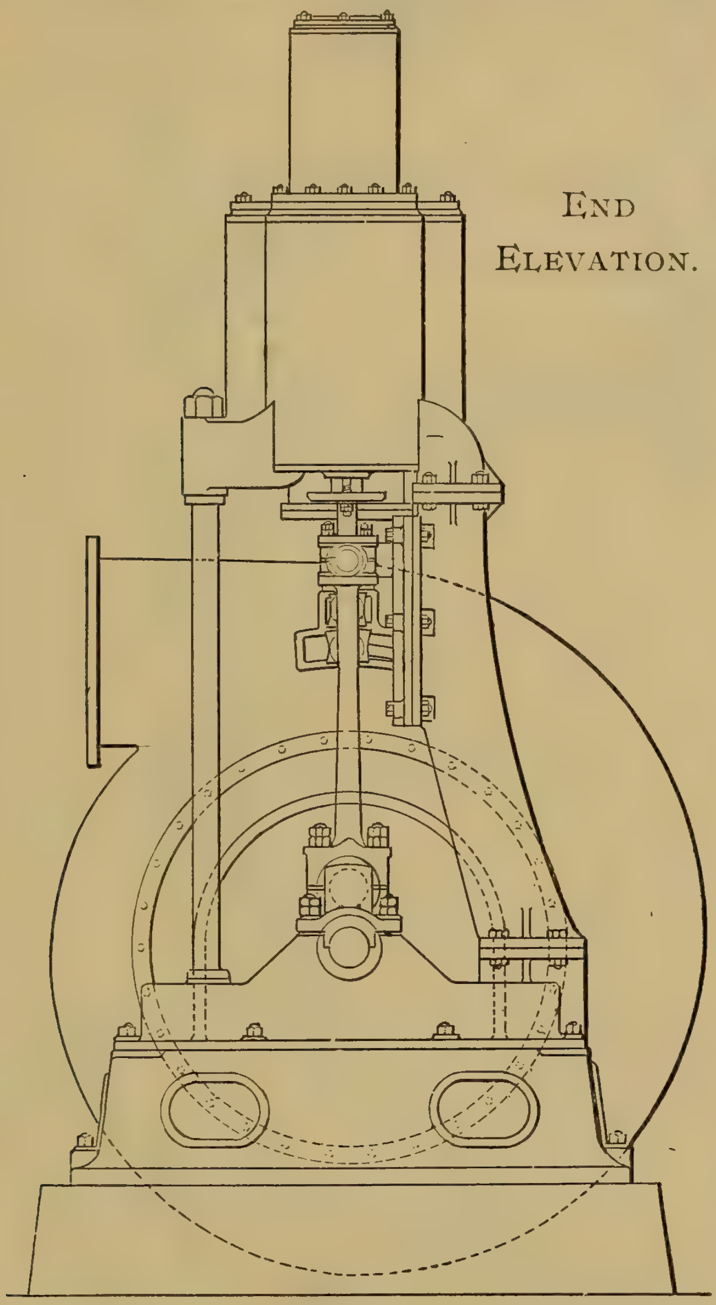
TRIPLE COMPOUND AND CONDENSING CENTRIFUGAL PUMPING ENGINE.

W. T. GARRATT & CO., SAN FRANCISCO.

Front elevation, one pump in section.—Pumps 24 inches bore.—Mounted on a continuous iron sole frame.—Capacity, 40,000 gallons per minute.—Machinery from which drawing is made was erected on a floating pontoon instead of a foundation.



Iron Works, of this City, refused to recognize the bids in competition, and it was not until Mr. J. H. Cooper, of Philadelphia, who had spent some time on this Coast, and was familiar with practice here, designed pumping apparatus that met the requirements, that



Triple Compound Centrifugal Pumping Engine.
W. T. GARRATT & CO., SAN FRANCISCO.

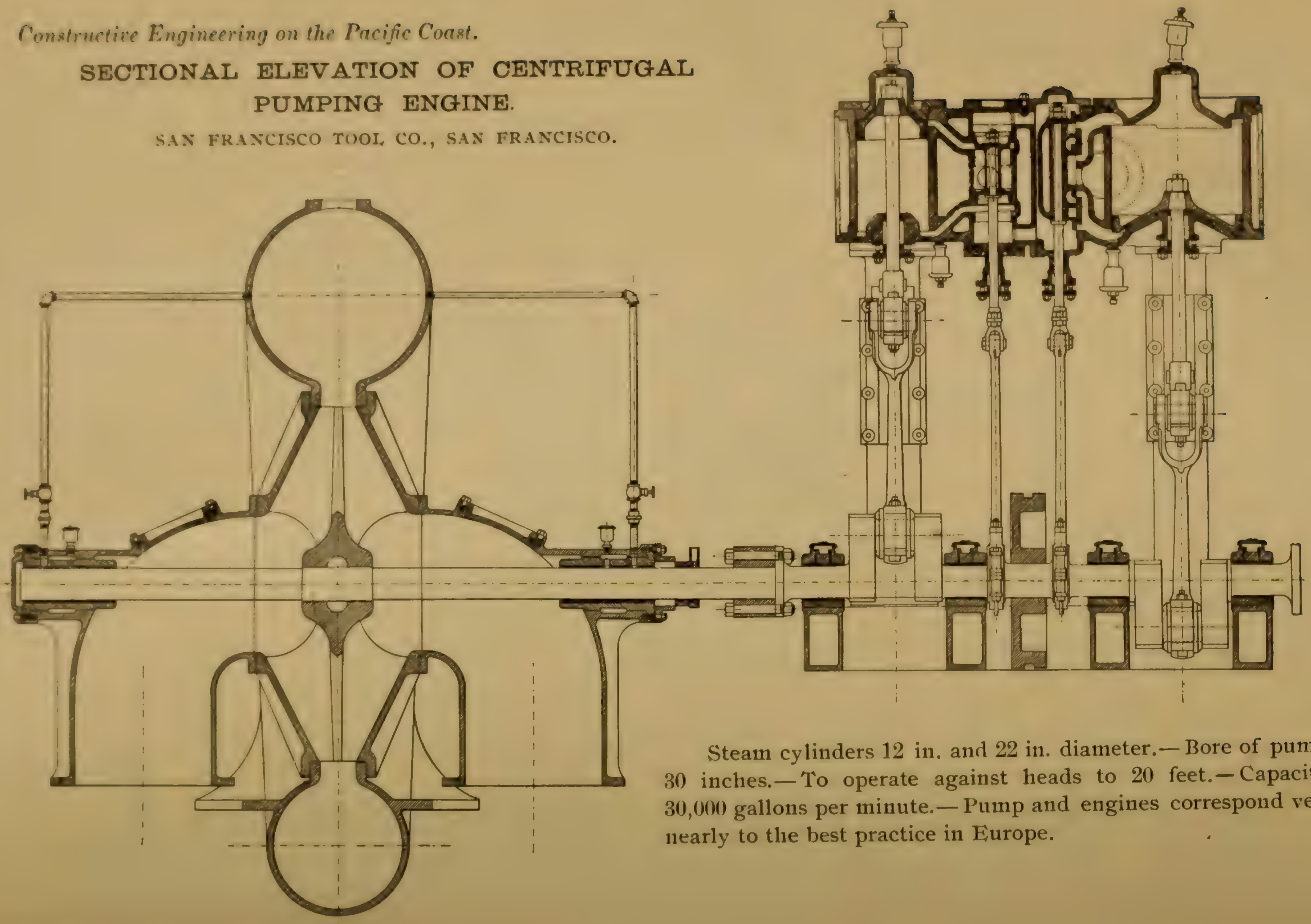
the Southwark Foundry, where Mr. Cooper was the engineer, secured the contract on a lower tender than was made from here.

In the face of these difficulties, and far removed from examples and precedents, draining machinery has been worked out here in a very creditable manner by several firms, as will be seen in the draw-

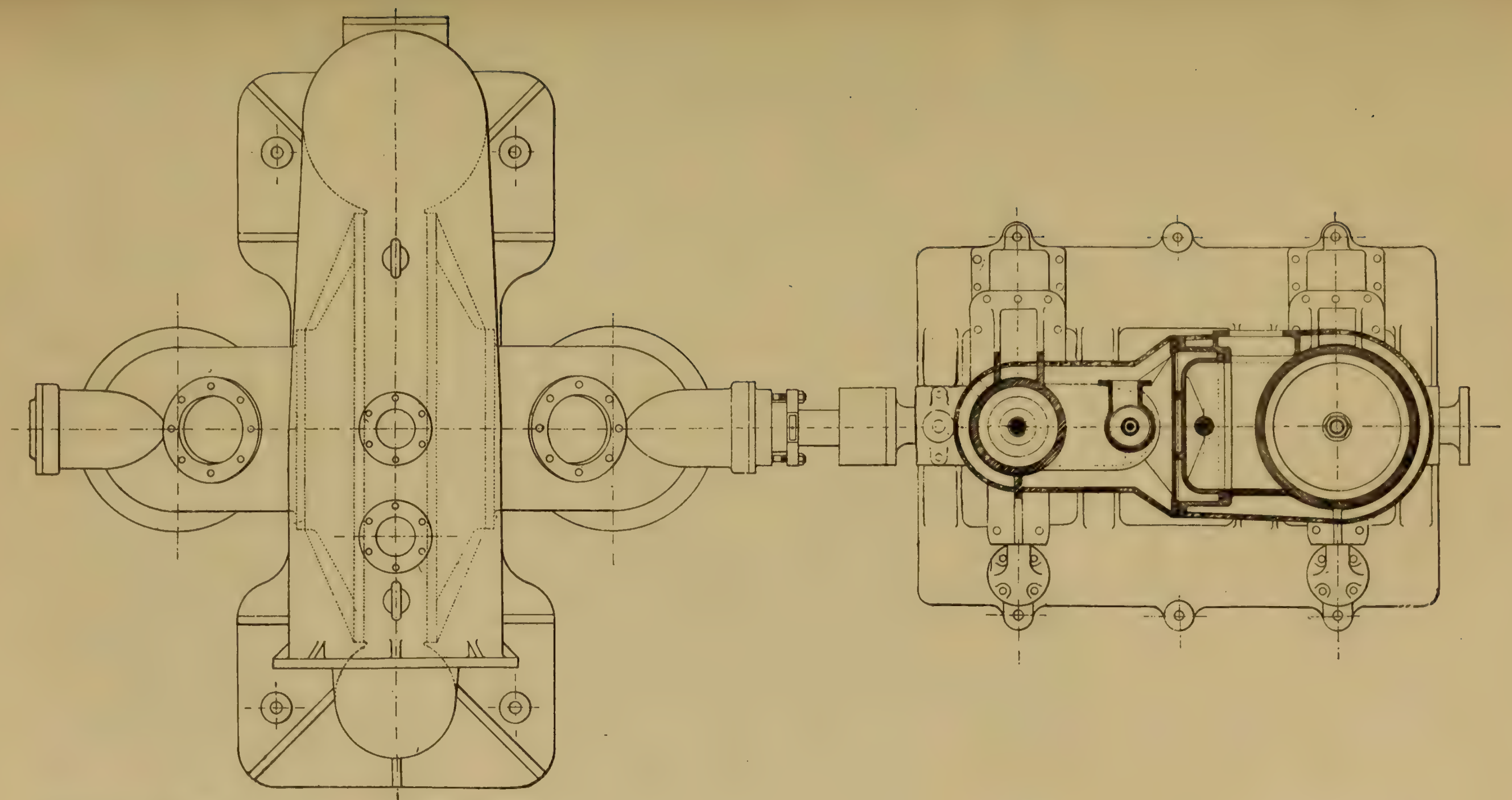
Constructive Engineering on the Pacific Coast.

SECTIONAL ELEVATION OF CENTRIFUGAL PUMPING ENGINE.

SAN FRANCISCO TOOL CO., SAN FRANCISCO.



Steam cylinders 12 in. and 22 in. diameter.—Bore of pump, 30 inches.—To operate against heads to 20 feet.—Capacity, 30,000 gallons per minute.—Pump and engines correspond very nearly to the best practice in Europe.



Constructive Engineering on the Pacific Coast.

PLAN VIEW OF CENTRIFUGAL PUMPING ENGINE.

SAN FRANCISCO TOOL CO., SAN FRANCISCO.

200 horse power.— Corresponds to the elevation on the preceding page.

ings, all taken from plants constructed and in use, and comparing favorably with what is done in the Old World on the basis of skill and efficiency, and far exceeding in economy of first cost any work of the kind we can refer to in other parts of the world. The whole plants, as a rule, not costing much more than two thirds as much as European works of the kind.

As will be seen, the machinery is self contained, adapted to be set on piles driven into the soft sedimentary ground forty to sixty feet, capped either with a monolith of concrete or floor of timber; if the former, weight and expense is avoided by imbedding rolled channel beams of iron in the concrete to which the engines and pumps are attached, thus avoiding heavy cast-iron frames.

The pumps are somewhat varied in construction, but are seldom arranged with a forked or double suction pipe entering at each side. This produces a tortuous waterway, obstructed by the pump shafts, and liable to be clogged with vegetable debris.

The main reason for employing double-suction inlets, so common in Europe, seems to be for the avoidance of lateral thrust on the impellers, but this need not exist with a single inlet, indeed is much more likely to happen with a double inlet by clogging with tule roots, bean straw and the like.

The divided pump case has also disappeared, as will be seen. No one thinks of such a construction for draining pumps, and it is not likely that the method will last much longer here, except for cases where the impeller and shaft have to be removed laterally, as for circulating pumps on shipboard.

The steam engines are much varied in construction, but of late years all are of high expansion and condensing, sometimes with triple cylinders, as seen in one of the drawings. Condensing, heating and charging apparatus has been reduced to its most simple form, and it is hard to see how much more can be done, except by refinements that the economical conditions will not permit.

The consumption of coal has been reduced to about two pounds per hour for each horse power in water raised, and this too is as much as is likely to be attained.

One important feature that greatly reduces the cost of reclamation machinery on the Pacific Coast is in the pipes. These, by reason of the skill here in that line of work, are made of thin sheet-iron plates, riveted, and so carefully put together that suction pipes will hold a vacuum the same as cast-iron pipes.

Around San Francisco alone there must be not less than 100 miles of such riveted pipe exceeding 24 inches bore, for conducting water under pressures up to 50 pounds, and more, per inch. It is a matter of amazement to engineers from other places, who visit here, and see the extraordinary methods of making and laying conducting pipes. Just at this time has been completed, by Messrs. Francis Smith & Co., of San Francisco, 22 miles of such pipe, most of it of 30 inches bore, the joints shoved together without flanges, or any of the common expedients, but as secure as possible. The exterior of the telescoped part is reinforced by a band, which constitutes the sole mechanical member involved in the joint, if we except some rivets where the changes of temperature are likely to disturb the joints. This of course relates to pipes laid under ground. Those exposed are joined by flanges, and in that manner answer very well for suction as well as discharge pipes in reclamation or draining plants.

The term "reclamation" is commonly employed, and is, in most cases, correct, because nearly all of the lands drained, along the rivers at least, were once above the floods, and are now submerged by the stream beds silting up with the washings from hydraulic mining. The bed of the Feather River, a tributary of the Sacramento, has been raised, it is claimed, 15 feet at Marysville, near its mouth.

Recent articles in "INDUSTRY," respecting centrifugal pumps on the Pacific Coast, anticipate a good deal that would otherwise be written in this connection. The drawings, however, indicate more than description.

(To be Continued.)

A CO-OPERATIVE CONTRACT SYSTEM.*

No. II.

Another gain equally important, is the avoidance of "scamped" work. This is a constant care and dread under the time system, calling for espionage the same as in keeping men at work. When the workmen in a shop are responsible for scamped work, and know it has to be made good at their own expense, common interest renders such work impossible, or at least rare. If a piece is spoiled by carelessness or want of skill, it is a curious proceeding to saddle

*J. Richards, in *The American Machinist*.

the result on the owner, and take the amount from his profits. To do such a thing puts workmen into an irresponsible position, constitutes them menials depending on a master's bounty and forbearance. It is putting skilled men in the position of slaves, their owner being responsible for their incapacity and carelessness, and is but an extension of the old paternal feudalic relation, that existed when labor consisted only of manual effort, and intelligence counted for nothing.

Under the time system an owner may hire a man and send him into a shop, where instead of earning anything he may spoil the value of a week's wages the first day. What is the result? The man can be discharged, but his wages must be paid for the time he was at work or employed. Was ever anything more inconsistent or degrading to skilled men?

Speaking further of scamped work, not by inference or theory, but from observed facts, the coöperative contract system begets a spirit among workmen that precludes bad work. This is hard to describe, but can be imagined. The secret of faithful service is responsibility. It is the basis of manhood and the incentive above all, that brings out what is just and honorable in all men. The responsible man is a freeman. The irresponsible one a slave, whose master is accountable and must make up the losses, and stand on guard against dishonest service.

In shops where the "free" system is installed, one might as well accuse a man of stealing as "scamping" his work. If it were stealing from the owners, as it would be in a time shop, that would be bad enough, but to steal from his fellow workmen, or diminish their earnings by deceit, which is the same thing, would be degradation, and "unsafe" in shops that I know of.

This pride in good work, it may be said, will exist in the case of individual piecework, or even timework, but the fact is, it does not, or is limited to a small share of the men, and as there is in this country a tendency to uniform wages under the time system, there is no incentive to promote a pride in honest work, or the *esprit de corps*, found among men who are independent and irresponsible.

Another distinct feature of the coöperative contract system is the facilities it affords for charitable care of workmen who are ill or wounded. The organization is in its nature one of the most perfect institutions of the kind ever devised for those who are disabled. Let us follow a case through and see how it operates.

Suppose a man in good standing (and you will not easily find any other in coöperative contract shops), should smash his fingers, break an arm, or meet with other misfortune. He is a partner in certain work going on, and his partners are naturally interested in the matter; they look into the case, and extend any aid needed, and as soon as the man can go about, he comes to the works and does "something," anything to seem engaged. He may not earn a penny a day at first, but he is on the pay roll, supported by his fellow workmen, by an indirect contribution from each man in proportion to his earnings. "Jim is a good fellow, and we will carry him through his misfortune," is a remark once heard in respect to a wounded man.

The owners have nothing to do with this directly. They are not watching to see if "Jim earns his wages," but are commonly called upon and never fail in deserving cases to contribute something for a doctor's bill, medicine, or in some other way. It is the most perfect system of aid that has ever been invented. Self-operating, so to speak, without a secretary, treasurer, visiting comittee, or other machinery of the kind.

Two other things in connection with the coöperative contract system require consideration — its practicability and its commercial effect.

The practicability of the system calls for intelligence and a good deal of special knowledge on the part of both employers and workmen. It is an evolution, not a discovery, and began as a remedy for labor disturbance and discontent. The most difficult part is rules for estimating or computing the prices for work, a thing much simplified, however, by computing superfices for all operations that can be thus dealt with, and the quantity is much more than anyone would suppose. This is carried so far in England that the rules for flat surfaces extend from a single rough cut up to surface plates. Turning the same, or from a roughing cut to standard fits or dimensions, to one ten-thousandth of an inch or less. Of course there are various qualifying conditions, such as the length or other dimensions, and the kind of material, but the rules take all these things in, and a quantity clerk has them at his finger ends, so to speak.

The rates are arrived at by long experience in uniform kinds of work, by the same men or the same class of men, and the practicability of fixing rates is shown by the fact that there are seldom disputes or differences of opinion between owners and workmen.

Lists would be hard to obtain. The coöperative contract system is in England a matter not often discussed, and one of the things not explained to foreigners. It is well understood there as the main cause why wages can be near double what they are on the Continent, and yet English products compete in the neutral markets of the world. The writer's opinion is that if, for example, the machine tool works of the Manchester district, were to adopt a "time-work" system, the business would fall in a year before continental competition. Such a view is not extreme. When visiting the Cornwall Iron Works of Messrs. Tangye Brothers at Birmingham, some years ago, in company with George Tangye, Esq., the manager of that great enterprise said, "Not even a screw-bolt is made here except by piecework. We could not conduct our business on any other system."

Speaking farther of practicability, ways and means for a coöperative contract system would soon appear if the scheme or idea was presented and considered as "profit sharing" now is, but how far we are from this can be inferred from the fact that in all writings and reports, Government or otherwise, on labor in England, no explanation or even mention of such a method will be found, and in none but later writings will be found any facts as to the *amount* of wages entering into the cost of work, only the *rate* being dealt with. It is then no wonder that workmen or even employers have not discerned that the main cause of labor disturbance lies in the fact of workmen being irresponsible, dependent, and in an unnatural relation to their employers.

The first thing is to explain the coöperative and independent method so it will be understood, and then begin the work of preparing for it, not only in skilled labor but in unskilled labor of most kinds—all kinds that admit of some determining measure on which prices can be based.

The New Zealand railways were in some cases constructed on this method, just the same as we followed A^{10} through the machine shop. The grading was estimated and let to companies of men. Tools, powder, and other equipment were furnished to the men when they had no capital to purchase such things, and settled for when the work was completed, or as it progressed.

There have been in this country some attempts in this direction, but, as in England, the methods and results are not published or made a public matter. In the Baldwin Locomotive Works, at Philadelphia, for example, the largest of the kind in the world, no

one has heard of strikes for twenty years past. When there was a strike there about twenty-five years ago, the owners, instead of declaring war "wrote a book," that is, explained to the men the relation that existed between them and the business, and then adopted some system not very well known, that made the men responsible and their work coöperative. These facts are set down from dim recollection, but will be found substantially correct.

The Pullman scheme at Chicago is the antithesis of this, an intensification of the dependent system, if we include the social phases of the matter. It is an attempt to carry out in this country the methods of Saltaire, in England, or Besbrook in Ireland, with a very different kind of people, a different business, and under totally different conditions. Salt and Richardson, the Quaker founders of these works, were philanthropists as well as business men, who gained and maintained a confidence not possible in any scheme founded on purely business objects, and as nearly all such works must be founded.

A coöperative contract system of working can be made amenable to the laws of a country, because the "quantities" and conditions on both sides can be expressed in exact terms, but no other of our methods of compensating labor can be, except as to abuses of person or property. The labor laws of a century past and their effect, or want of effect, show the futility of attempting to define the conditions of labor when there is no measure of the service or product. The laws of contract will not apply when the consideration on one side is an indefinite or undefinable thing, and when wages, as in timework, is a kind of largess for the use of muscles and mind during a period of time.

Paternal systems, such as profit sharing, may for a time and in some cases prevent labor disturbance, but the chances are that all such relations between employer and employed, will in the end lead to increased discontent. Profits, like timework, are an undefinable quantity, a sequence of bookkeeping, and a matter with which workmen have nothing to do, except in so far as their labor is one of the factors in production. When we build a house, it is commonly contracted to a carpenter, mason, painter and plumber. Each contributes his part and receives his pay independently. The painter does not expect a part of the carpenter's profits, and could not receive them in any manner not compromising his dignity and independence. The same with the other two—they do their own part. Now, the difference is that the house, the completed product,

is a measurable commodity; so are its elements, because we are familiar with houses and can predetermine their value. Why are not machines, wagons, clothing, hardware, woodwork, and so on, constructed on the same system? Is it not the want of some way of measuring the labor and other elements, as they are computed in the case of A^{10}?

Here is a broad subject, compendiously and imperfectly presented, a remedy for strikes that interposes manhood, independence and interest against such a childish expedient as throwing down one's tools and refusing to work. The paternal schemes of a bonus, share of profits and attempts to starve workmen, are the childish part on the other side, and between the two we are making no progress whatever in dealing with the greatest social and industrial problem of our time.

EXTRACTS FROM A NOTE-BOOK.

BY "TECHNO"

No. XXVII.

AN INDIAN MASSACRE.——A QUEER WATER-CRAFT.——AN ESSAY ON "BILERS."——A CAST-IRON DOCTOR.

Some time, perhaps not long hence, this will be classic ground, here about the Falls of St. Anthony, in this upper river country. Indian stories and traditions are as thick as legends on the Rhine, most of them nearly as absurd, and all of them, I mean as a lot, are equally true. One, however, is true. That of the Winona massacre in 1861, when the Sioux warriors called down from the North to be paid their annual stipend, and failing to get money set to work and murdered a large number of people in Winona Valley.

The circumstances were so overshadowed by the great events of the Civil War, then transpiring, that people have forgotten this, one of the greatest Indian massacres that ever took place on the continent. An old resident of the country, we happened to meet, thus told the story, which I have set down in his own words as nearly as possible.

"Ingens are bad, no doubt, especially Sioux, that is, they are not afraid, and sullen cruel scamps, but Ingen agents is worse. The money was sent out here from Washington for the Ingens, and they were asked to come down here to Winona to be paid. By the time

pay day comes around these fellows have no ammunition, no blankets, nothing to eat, and are just like a lot of half-starved cattle running to water and feed. Several thousand came to Winona, Sioux, Chippewas and others. The money got here in time, all in coin, but the cussed agents discovered that by sending it back to St. Louis and exchanging it for paper bills they could pay the Ingens and pocket the premium, which all at once had jumped up to twenty-five per cent. or more.

"Now just think of it. Here was a wild starving crowd of savages, without anything to eat, and no shelter; squaws, children, old and young devils of all kinds, starving crazy, and believing that the Government had fooled them, and enticed them down here to die. I don't want to excuse Ingens, but just think of it. They kept getting wilder and hungrier, until at last out came the knives, hatchets and clubs, and the settlers were killed right and left. It was terrible. The soldiers soon settled the matter, and, as you know, thirty-five of the wretches were hung, all in rows like blackbirds on a limb, and the pity was that an Ingen agent was not strung up between each pair of Ingens."

This matter I must leave to history, and also would willingly omit some remarks on "Ingens" by my Uncle, that followed, but candor demands its inclusion now that the subject is open.

"The Indians of North America," said he, "are a strange race of wonderful diversity, but all with strong passions and a kind of rude manhood that is not common among other savages. They do not like to be lied to, and once they are deceived that ends their confidence forever. They look with distrust on white men, and with good cause. We always manage to send our worst men to come in contact with the Indians, I mean in a civil capacity. An 'Indian agent' is a synonym with Jeremy Diddler, with cruelty thrown in, and the treatment of the Indian tribes must pass down in history alongside of negro slavery in this land of the free and home of the brave, or as a common rendering of it some years ago, which substituted 'slave' for 'brave.'

"Old William Penn had no trouble with Indians, neither had the British Government, nor has the Canadian Government. Go a hundred miles from here, across the line into Canada, and you will find there is no trouble with Indians, not the least, never has been, and never will be so long as they are treated in good faith. This is easy to understand. Savages, or, to use a better name, uneducated people, have certain traits just as strongly developed as what we call

civilized people. They have confidence, respect and resentment, and passion just the same, but are wanting in penetration, or the faculty of divining the intentions and schemes of men skilled in arts mysterious to them, so they are always ready to believe and exaggerate whatever savors of deceit. The difficulty with our people, and all others who call themselves civilized, is that they want to thrust on other people their customs, religion, whiskey, guns, penitentiaries and general rascality.

"I have been among Indians a good deal, not here in this country, but among real Indians, natives of India, where there is no whiskey, no stealing, and, I believe, more religion than I have yet found among white men. I am not speaking of Mohammedan India, or Bhudistic India, but the whole of it, or so much as is reached by the common lines of travel. These natives here should not be called Indians any more than Italians or Russians. They have nothing to do with India, moreover are not like Indians, except as to color, that means the same in men as it does in horses—an accident of environment only."

We finally got started on a steamer, to me a queer kind of craft that seemed to require some bale ropes and shores to hold it together. It was an example of attenuated cheapness, that cost per ton, or square yard, about as much, perhaps less, than would have built a house of like size on the land, still it was, except as to flimsiness, comfortable, convenient and steamed at a fair speed. The most annoying thing was the vibration. One could not read in the vicinity of the wheels, and everthing loose seemed to be crawling about with the jar, but the scheme, so to call it, is ingenious withal. There is more steamboat for the money than any one would suppose possible, and that where money is by no means cheap or plenty. Allegheny pine, the white soft aromatic fir of that name, but mostly coming from the northwest, is used for almost every purpose. The whole upper works are of pine and paint, the latter tasteful and laid on thick, a fearfully combustible arrangement, which the chief engineer told me would burn up in five minutes.

Strangers who come here are on the lookout for boiler explosions, myself among the number, and apprehension was increased by a grizzly old native in the hotel at St. Paul, who volunteered some history in the matter that was not of an assuring kind, and here let me say that positive knowledge does not protect the human mind from the influence of error. I know as well as a person can well learn when a boiler will explode, or the circumstances under

which it will "come away," to use a sailor's expression, but here I find myself influenced by the twaddle of an ignorant old fellow, who could not distinguish between a steam boiler and a saw log if the two were side by side.

"Bilers," said he, "don't explode now as much as they used to. There aint so many of them for one thing, and the men are too lazy to fire them, but we don't know any more about it now than we did fifty years ago, when the *Red Wing* went up, nor when the *Moselle* went up sixty years ago, at Cincinnati, and left nothing but a hole in the water. The trouble is there are so many causes people can't find them out. The polarity of the water is one cause, crystallization is another cause, and decomposition of the water also, besides the bottom gets covered with mud and blows out. Some folks say it is too much pressure, well, there must be pressure around or else there would be no force, but steam pressure alone don't act like gun powder, and hoist a whole steamboat into the air, a thousand feet high. There is something more, and you can't get a steamboat man to subscribe to such a theory. It won't do, it aint reason, a biler must have a weak spot. Why don't that go first, and when it does go a square foot of hole would let all the steam out in a wink, or half a wink. You may talk about ingines and machinery, and all that, and I am bound to believe what you say, but on biler explosions your theory won't work."

I do not want to bring discredit on the venerable faculty of my *alma mater*, but there was one thing, and only one in the crude lecture above recited, that shook my confidence, and that was the weak point in a "biler," and why a rupture did not end there as soon as "vent" was gained, unless relief of pressure permitted all of the water to flash into steam.

————I went down on the lower deck, about two feet above the water line, and examined the engines. They were set on solid keelsons of timber, inclined about ten degrees to the crank shaft, puppet lever valves, wooden connecting rod, and between them a "doctor," who did the pumping for the vessel independent of the main engines. How this latter-named implement got its name the annals of the river do not explain, but is a "doctor" everywhere. The word "auxiliary" had not found its way out West when these doctors were invented, but name aside I must set them down as the most complete thing of the kind I had ever seen. This view, however, as it must be here written, is not wholly my own, because I consulted my Uncle on this doctor problem, and found as

usual he had, at some time long past, put the subject through his crucible of analysis in the usual manner.

"These Mississippi steamboat doctors," said he, "represent the finest mechanical combination in the whole range of steam machinery. They are essentially a plain beam engine with a row of pumps on each side of the beam. The fulcrum frame is composed of hollow columns, the best form possible, performing also the function of pipes. There are supply pumps, I never say feed pumps since the Frenchmen have translated the name as *pomp alimentaire*, or food pump; there are bilge pumps and other, as many as are required. Everything is on end, consequently condensed into the smallest space possible, the strains are nearly direct on all connections, and there is one feature you may have overlooked, the action of the fly wheel.

"On all land pumps having a fly wheel the idea is to produce uniform rotation or speed. Of course the primary object or function is to regulate the stroke, and obtain proper valve motion, but, as said, the 'idea' is to secure tolerably uniform speed of rotation. In a doctor this is not looked for. There is not much room for a fly wheel, and not much for it to do. It carries over the centers of course, but the idea is to permit the steam piston to act directly on the water pistons, or as much so as possible, and this produces very irregular motion. In effect it is a direct-acting steam pump with a regulated stroke, and a plain slide distributing valve for the steam.

"These doctors are reliable in every way. They stand in open view between the engines, and the least derangement of the pumps is at once detected by the symptoms. They have more science in them than the whole auxiliary pumping outfit for a man-of-war. By science I mean common sense, the two terms being in a way convertible. The doctor goes on forever, I never knew one to fail. Everything about the pumps is in duplicate, for the double purpose of balancing forces and furnishing a relay in case of accident. You may find all the fault you will with the wooden engines, sheet-iron furnaces, and slam-bang valve gear, but be careful what you set down in disparagement of the 'doctor.' When I build a steam ship, or erect a large steam power on land, both of which events are alike improbable, I will first thing buy a steamboat 'doctor,' and then build the rest around it. It is fifty years old, without a blemish in its reputation, and has never been improved so far as I know. The first doctor was like the last one. The cast-iron eagles on the beam and the vermilion paint have gone out, but the main features are all there, and will stay there."

(To be continued.)

THE CALIFORNIA ACADEMY OF SCIENCES.

The Academy of Sciences has fallen under some severe criticism recently, and no doubt with some cause, but as these criticisms concern the personnel and management they do not fall within the province of criticism here. They are the result of inevitable consequences attending on any institution that is well endowed, and cannot set up a gauge or qualification for its membership.

There is a natural hungering for some association that will lift men above the sordid atmosphere of trade and social commonality. The church, public office, and frequently the bestowal of wealth are means to such an end, and when such an opportunity occurs as is presented by the California Academy of Sciences, it is but natural that without some bar the secular membership should overslaugh the science element of the organization.

The natural sciences, which are presumably meant by the plural title, is a vague term, covering from the highest learning of which the mind is capable down to the microscopist who has learned nothing. There is no line at which a member can be called eligible for membership, and not even a popular understanding that would render such a line tangible if set up, so a miscellaneous membership is the natural result.

The active work done, measured by a standard of direct utility, does not seem to be much, and might be vastly increased by the inclusion of such branches as physics, chemistry and metallurgy, with others that involve definite qualifications, permit a standard of membership, and connect the work done with the practical affairs of life.

Sections could be created that would not interfere one with the other, and thus prevent in this narrow field of the Pacific Coast that blight of "diffusion" that is the constant characteristic of research in this State and elsewhere. There are now geographical, astronomical, technical and other associations of a scientific nature, each maintaining a separate existence, all perhaps cramped for the want of room, service and facilities, with other expenses, and wasted effort that could be saved if these were all sections or branches of the Academy of Sciences. The membership, resources and prestige of the Academy would then become a great feature of this City,

and the central management by a council would be much more simple and successful than by the diffused system that now exists.

Consistent with this idea of such institutions, we have always contended that a similar course should have been followed by the Franklin Institute, of Philadelphia, where a want of room, and perhaps some feeling of exclusion, permitted the founding of the Engineers' Club and some other associations that should have remained under the patronage of the old Institute.

Affecting a policy such as is indicated, are the conditions of the bequest of James Lick, that forms a principal fact in the existence and possibilities of the Academy, and with this, to some extent at least, popular opinion, because the bequest was certainly not pesonal or for any other than a public object in the end, and from opinions that have appeared one may well question if James Lick had not in mind "applied" as well as natural science when he so generously endowed the Academy.

The natural sciences are extensively aided by the State in various branches that affect industry and public interests, but the physical sciences, except in a limited and accidental way, have no such aid, and rest on personal endeavor or business incentives. This is a reason for the Academy of Sciences extending its influence in this direction, and growing as it should into an institution that would not only emulate but excel all other organized efforts of the kind on this Coast, and perhaps in the whole country.

There should be a constant succession of popular lectures, and a technical library of reference, the latter needed here to an extent known only to those requiring such aid. All this, and more, can be done without impairing the fund. What is required is able and comprehensive administration.

DYNAMITE GUNS FOR SAN FRANCISCO.

BY EDWARD A. RIX, SAN FRANCISCO.

Upon the heights immediately back of Fort Winfield Scott will soon be mounted the three 15-inch dynamite guns for the protection of the entrance to the harbor of San Francisco. The recent tests at Sandy hook, conducted for the Government, have shown beyond a question that, for the purposes intended, no other engine of warfare which casts a projectile has more than a small fraction of the accuracy and destructiveness of these dynamite guns.

The guns are 50 feet long, having a bore of 15 inches, and are mounted in such an ingenious manner that the recoil is not an element of consideration, while at the same time they are so lightly adjusted that small electric motors within the carriage, manœuvre the gun from extreme depression to extreme elevation in 15 seconds, and a complete traverse in less than two minutes. A shell containing 500 pounds of dynamite can be loaded and fired in three minutes, and lesser projectiles in from one and a half to two minutes.

Depending on the weight of the projectile these guns have a destructive range up to between 6,000 and 7,000 yards. Projectiles having a lesser diameter than the bore of the gun can be thrown as accurately as the full calibered projectile by simply enclosing the ends of the sub-caliber projectiles with wooden pistons in sections, which fly off as soon as the projectile clears the gun, leaving it free in its flight.

As for accuracy, which is of course the vital element in any gun, the results of the Sandy Hook tests were little short of the marvellous. Five successive shots with the full calibered projectile loaded with an average of 520 pounds of dynamite, and with an average total weight of 1,148 pounds, and a length of 11 feet, traversed 1,920 yards in 17 seconds, and every shot landed within a rectangle one half the size of that which would circumscribe the United States vessel *City of New York*, and every shot exploded.

The results with eight successive shots with the 10-inch sub-caliber projectile were more remarkable. These projectiles carried 214 pounds of dynamite, had a total weight of 568 pounds, a range of 3,590 yards, and occupied 19 seconds in their flight. Three of these shots struck in the same spot, another group of three in one spot but five yards distant from the first group, and the other two ranged in the line of fire, and but 23 yards distant, making the rectangle circumscribing these shots about one half the length and one fifth the width of that circumscribing the *City of New York*. All of these shots exploded.

The results of five successive shots with the 8-inch sub-caliber projectiles, carrying 110 pounds of dynamite, having a total weight of 305 pounds, at a range of 2,560 yards, and requiring 19 seconds for flight, showed that they all struck in a rectangle having the length and one fifth the width of the *City of New York*.

It is unnecessary to say that no modern gun using an explosive can approach these results. No better proof of this can be shown than that the requirements of this test based on the average possi-

bilities of an ordinary gun were exceeded 2,000 per cent. by these pneumatic guns. While this result is far in excess of what one would predict, still there is no one who reflects upon this matter could doubt the wonderful results attained, were he acquainted with the accurate and delicate mechanisms that Captain Rapieff, the chief ordnance engineer of the Pneumatic Torpedo and Construction Company, has introduced in these guns for regulating the amount of air, and for instantly cutting it off, and for also eliminating the personal equation of the one who fires the gun.

There is no good reason why, with atmospheric conditions favorable, two projectiles weighing the same, and equally well made, and of similar dimensions, propelled from the same gun by the same initial pressure, and with the same cut-off, should not strike in the same place, and this after any hour, day or month of repose in the plant, and all of these conditions can be easily and accurately produced and reproduced at will, with no more skill required than is possessed by a good stationary engineer.

This can never be done with an explosive, for two charges which might be identical one day may not be after a short lapse of time, and even at any time they would not produce equal volumes of gas of equal pressures in equal times. Where explosives therefore are used in guns, the best condition for accuracy includes a range far less than the maximum, while with compressed air the range is accurate to within a small percentage of the limit. Compressed air does not destroy the guns, as does powder, and they grow cooler with each successive shot, instead of hotter as with ordinary cannon.

The air pressure used is 2,000 pounds to the square inch, and the compressors must deliver 450 cubic feet per hour of compressed air at this enormous pressure to furnish the requisite amount of air for the three guns at Fort Winfield Scott.

The Fulton Engineering and Shipbuilding Company, of this City, has been awarded the contract for the complete boiler, compressor and electrical plant. This will be the largest plant for this pressure ever built, and many new and unique problems must be solved in its construction. One of particular interest will be to accurately determine the proper amount of cooling surface in copper pipes, to reduce the temperature of air after each stage of compression to within twenty degrees of the temperature of the cooling water.

The need for this information arises from the nature of the method of compressing air to high pressures. It is neither expedi-

ent nor economical to compress air directly from the normal condition to 2,000 pounds. It is first compressed to 75 pounds, and the heat extracted to within 20 degrees of the cooling water; then compressed to 375 pounds, and the heat again extracted; then compressed to 2,000 pounds, and the final heat extracted.

The volumes of the air decrease in a geometrical ratio of five between each compression, but whether the cooling surface in the intercoolers should in a similar ratio is a fact which has yet to be determined accurately. It has been guess work thus far, with very poor results. In this plant this matter will be determined experimentally; cooling water will also be introduced into the ram plungers, and its effect compared with simple jacket circulation, and experiments will be made with and without the intercoolers, and with and without water jackets; also the relative power consumed in high or lower piston speeds will be determined, and also the percentage of air delivered to the cubic contents of the initial cylinders.

It seems certain that shortly there is to be a deep interest taken in compressed air, for it is the most satisfactory and flexible medium we have for transmitting power. The cost of its production is being continually cheapened, until now it is on a good commercial footing with any other means of power transmission. We hope with this 700 horse power plant just described to conduct some experiments that will add something to the meager practical data now extant on the subject of compressing the atmosphere beyond the ordinary pressures.

THE MERCHANT MARINE.

The late meeting of the Institute of Naval Architects and Marine Engineers, at New York, was devoted mainly to war vessels and the Navy, in which a good many people, perhaps the most of them, take less interest than they do in the "merchant marine." Among the non-combative contributions, was one by Mr. G. W. Dickie, of this City, manager of the Union Iron Works, from which the the following extract is taken:

"In order that the United States may participate in ocean commerce, to the extent that her own imports and exports entitle her to, there must be, first, a patriotic ambition throughout the country, to carry the products of our industry under our own flag to every country which cares to exchange products with us; second, wise national laws to protect and foster our merchant marine; third,

State and municipal laws on the part of the seagirt States and maritime cities, encouraging ship-building and ship-owning within their own borders.

"At the time when the United States may be said to have had a large share of the ocean carrying trade of the world, in proportion to her wealth, that wealth was largely confined to the States having a seaboard on the Atlantic, and accumulated wealth naturally sought investment in ocean commerce. With the interior development of the vast country lying between the Atlantic and Pacific, came that vast net-work of railroads, which not only absorbed all the capital of the older States, but raised a mountain of debt, largely due to foreign capitalists, that is today sapping the financial life of the country. The overshadowing power of the aggregation of capital represented by the great railroad corporations, the rapidity and ease with which large fortunes have been made in the manipulation of these great interests, have drawn men's minds away from the more sober business of ocean transportation. As the people engaged in the industries of this country, recover from the overdose of railroad, from which they have been suffering during the past twenty years, the great natural highway of the nations will receive attention, and our Atlantic seaboard will wake up with her old love of the sea, strong as ever, and the Pacific slope will find more wealth in the Pacific than has ever been dug from the Sierras.

"The British government never permits an opportunity for cultivating a healthy sentiment on the part of the general public in regard to naval matters, to pass by unimproved. Maritime exhibitions are fostered at her principal sea-ports. Naval manœuvres are carried out along her whole coast. Launches and trials are made semi-public functions. All the traditions of the past glories of the naval and mercantile fleets of England, are made part of the education of the youth. No matter what the programme may be for increasing the British navy, the country responds heartily. At the launch of the battle-ship *Oregon*, in San Francisco, no government ship was there to represent the navy. Not a gun was heard to herald the event. The builders to make a decent show had to go around and beg the English merchant ships to dress up in their best bunting, which they did, to the delight of the natives, who did not seem to realize the true meaning of such a display.

"This brings us to our second requirement, that of wise national laws to protect and foster our merchant marine. Several acts of Congress have been passed, having for their object the revival of American ship-owning and ship-building, but, so far, they appear to have failed in accomplishing any satisfactory results. Quite a large number of those interested in shipping matters, claim that, as foreign commerce can only be prosecuted in direct competition with all the world, American ships, built of protected material, and with protected labor, represent an invested capital so far in excess of their competitors that, even with other things equal, the contest is too one-sided for any hope of success. We are very apt to

condemn such a presentation of the subject as unpatriotic, but it is business truth. We must either build ships for the ship-owner at the same price as that paid for a similar ship with which he competes, or else give him the privilege of buying his ship where his competitor buys his, to make the struggle an equal one; and as, with material and labor at the present rates, it is impossible to meet the European price for a merchant ship, and it being the will of the people that ship-building should have a like protection with engine-building or bridge-building, the free purchase of ships abroad would be as unjust to the ship-builder, as the free purchase of engines would be to the engine-builder. It follows, therefore, that if there be a strong sentiment throughout the country in favor of a revival of American ocean commerce, the American ship-owner should, from the public purse, be placed on an equal footing with his foreign competitor. This being purely a matter of national busines competition, our law-makers at Washington should see to it, that no merchant-shipping Act of Parliament places the British ship-owner in such a favorable position, but that a merchant-shipping Act of Congress will do a little better for the American ship-owner, even if it does cost a little to do so. Public moneys thus spent would be but a small commission on the trade thus secured for the country.

"There is a grand opportunity for the establishment of a great American steamship line between San Francisco and New York, via the Straits, taking in the principal seaports of South America. We believe that a business could be built up to admit of two steamers per month, having a general freight capacity of 6,000 tons each. These vessels should have speed enough to insure 65-day trips, and should have first class passenger accommodations for a limited number of cabin passengers between way ports. They should be designed so that in case of need the government could use them for cruiser transports. They might also be partly or altogether manned by a naval reserve force. Such a line would eventually give us South America for a customer, and the government aid in the form of a mail subsidy or a mileage rate would be as nothing compared to the benefits that would result to the trade of the country.

"The third help that is needed to foster ship-building and ship-owning, should come from the State and municipal legislation. The laws relating to floating property differ in the various seaboard States, and statements that apply to any one State cannot apply to another. If we consider the question of taxation, the constitution of California provides that all property, real or personal, found within the State on a certain date of each year, must be taxed on its actual value at the time. While ship property may not be actually within the State, the evidence of its ownership being found in the custom-house, it is taxed accordingly. For instance, a vessel owned and registered in San Francisco, and valued at, say

$200,000, has to pay the same City, County, and State taxes as a building on Market Street, valued at the same amount.

"Apart from the crushing load thus imposed upon the ship-owner, there is the manifest injustice of such a method of taxation. The vessel thus taxed can receive no benefit whatever from the expenditure of the taxes that so materially reduce her money-earning capacity, while other property receives the full benefit that can be derived from the public service. Police service is provided for the city property. The vessel is beyond such protection, and must take care of herself as far as State or city is concerned. The city property has street lights provided in the darkness. The ship property in the midnight storm is not sailing through a street with electric lights on either side to show the way. An expensive fire department is maintained by the taxes to save the city property from destruction by fire. A vessel finds fire in the cargo; but there is no fire alarm to turn out the fire department in her case. Her own resources must be depended upon to save her. In fact, no part whatever of the tàx, which amounts to over two per cent. per annum of the value of a vessel owned in San Francisio, is expended for the benefit of the property thus taxed. Worse than that, when she lies at the wharves of the city, which is governed and adorned by the expenditure of the tax levied upon her market value, she must, in addition to it all, pay the same rate per day wharfage as the foreign vessel that lies next to her, and which is subject to no such burden.

"Now the wharf is to the ship what the street is to the building. What a howl would be raised by the owner of this building if, after he had paid the taxes that build and maintain the streets, he were not permitted to open his door and come out on the street, or move any goods from his building without paying ten or twelve dollars per day for streetage. And yet the case would be similiar to that of a city-owned ship at one of the city wharves."

COAL AND IRON IN CALIFORNIA, 1894.

BY J. W. HARRISON, SAN FRANCISCO.

The uniformity of prices for cargo lots during the year is unprecedented in the coal trade. There was no change for the first seven months, and the values will not show a variance of 5 per cent. until the tariff reduction of 40 cents per ton on bituminous grades, causing a decline equal to the exact amount of the tariff change*. The large fuel consumers cannot complain of the prices they have had to pay this year, as they have been the lowest ever known. The con-

*Some of the newspapers, also coal dealers, here in San Francisco have asserted that no change took place in the price of coal because of the reduction of duty. Mr. Harrison's statement can very well be set against such assertions.—Ed.

sumption should have been largely increased on that account. The seasonable rainfall, the exceedingly low prices of pig iron and coal, and the gradual return of confidence, should lead to increased trade in the near future. There is indication of a possible 20 per cent. increase of fuel to be consumed in 1895, and no article so forcibly betokens prosperity as an increased coal demand. We may feel gratified at the slight concession by the present Congress. The prosperity of our industries depends in a great measure upon the *total abrogation* of the obnoxious tax on coal.

The following table shows the average price by cargo for each month in 1894:

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.
Australian (gas).....	6.25	6.25	6.25	6.25	6 25	6.25	6.25	6.00	5.62	5.62	5.50	5.62
English Steam......	6.50	6 50	6.50	6.50	6.50	6.50	6.50	6.50	6.25	6.25	6.00	6.00
Scotch Splint.......	7.00	7 00	7.00	7.00	7.00	7 00	7.00	7.00	6 62	6.62	6.00	6.12
West Hartley.......	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.50	7.25	7.25	6.75	6.75

The various sources from which supplies have been derived are as follows:

	Tons, 1891.	Tons, 1892.	Tons, 1893.	Tons, 1894.
British Columbia	652,657	554,600	588,527	647,110
Australia	321,197	314,280	202,017	211,733
English and Welsh...	168,586	210,660	151,269	157,562
Scotch...............	31,840	24,900	18,809	18,636
Eastern (Cumberland and Anthracite)..	42,210	35,720	18,960	16,640
Seattle (Franklin and Green River).....	178,230	164,930	167,550	153,199
Carbon Hill and South Prairie..........	196,750	218,390	261,435	241,974
Mount. Diablo and Coos Bay	90,684	66,150	63,460	65,263
Japan, Etc...........	20,679	4,220	7,758	15,637
Total........	1,702,833	1,593,850	1,479,785	1,527,754

To insure a correct statement of the entire amount consumed I have included all the arrivals by water at San Pedro, Port Los Angeles and San Diego, aggregating 208,036 tons.

The total imports of coke (all foreign) this year, were 24,492 tons; in 1893, 29,645 tons. Foreign pig iron this year 1,172 tons; in 1893, 3,538 tons, with a very promising outlook for large sales of American

iron in 1895, as the quality is suitable for foundry uses, and it is quoted below Scotch, even at the reduced tariff of $2.00 per ton. No foreign scrap iron has been imported this year, which shows that the manufacturers of nails, etc., have had a very light business; in 1892 11,113 tons of scrap were imported, and in 1891 21,885 tons. Iron melters have encouraging prospects for an increase of business the coming year, with the lowest prices ruling ever before known for iron, coal and coke. They are certainly placed on a footing now to compete with their Eastern competitors in the manufacture of nails, bar iron, rails, stoves, etc.

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

At the regular monthly meeting, January 4th, Mr. Ernest A. Hagen, of Oakland, Cal., consulting engineer, was elected a member, and Mr. F. M. Miller, of Grass Valley, Cal., a junior member of the Society.

The meeting acted upon the proposal to join the Association of Engineering Societies in the publication of proceedings, and a ballot resulted in the adoption of this method. This will cheapen the cost of publication, extend the circulation of the papers selected for printing, and secure to the members copies of the proceedings of a number of other engineering associations in the East.

The nominating committee presented the following names selected as officers for the ensuing year: President, Geo. W. Dickie; Vice-President, W. G. Curtis; Secretary, Otto von Geldern; Treasurer, Geo. F. Schild. Board of Directors, Louis Falkenau, W. F. C. Hasson, Randell Hunt, J. D. Isaacs, Jos. C. Sala.

Mr. A. M. Hunt read a paper presented by Mr. J. Richards, entitled "Pressure and Impulse in Motive Engines.—A Look Into the Future." This paper is reprinted in the present number of "INDUSTRY."

Mr. A d'Erlach read a paper entitled "Some Notes on the Latest Project for the Alpine Tunnel at the Simplon."

Both the foregoing papers were discussed at some length.

The committee appointed to confer with the Mechanics' Institute in respect to a coalition of the Technical Society with the Institute, reported a conference between committees of the two associations, and was continued for further action.

AMERICAN WOOD-PLANING MACHINES.

In March of last year Mr. Joseph Long in the *Woodworker* published a courteous reply to some remarks of the writer on American wood-planing machines, republished from "INDUSTRY" of January, 1894. This article has been laid away and overlooked for some time, but requires a rejoinder, because the subject is an important one, also is a matter of facts instead of opinions.

Mr. Long writes, as he admits, without any knowledge of other than practice in this country, and confines his argument mainly to the fact that people in this country are satisfied with their methods of planing, which is certainly the case, or has been until recently, but he is in error in alluding to our operations being as "a giant to a pigmy" compared to European mills.

Depending on the Baltic region is a market of about 400,000,000 of people with a civilization much like our own, and consuming wood products, not to the same extent, but nearly so, in the kind of work that passes through wood-planing machines. They have cabinet furniture and houses the same, and larger establishments for joiner work than we have, also a practice as advanced, if not more so, in the finer kinds of work.

In sawing, mortising, moulding, tenoning, cleaning off, and all the operations of finishing, they have not only all that we have but a good deal more in order to deal with timber that no one would in this country think it possible to work. For example, in the works of Bark & Warberg, Gothenberg, Sweden, there are very complete machines to cut the "knots out of door panels," and replace them with nicely-fitting plugs, the latter cut out with core augers, and pressed in with glue, so to not be seen except on close inspection.

There are knots everywhere, and stringy tough timber unknown in our mills. It must also be considered that while most of our door, sash, and other joiner work, is of a plain cheap character, most that is made in these Swedish mills is for the markets of Berlin, Hamburg, London, Paris, Vienna, and other large cities, where joiner work is much more elaborate than with us. Compare a French or German window, for example, with one of ours.

In any large works in the Baltic country will always be found people who have gone over the United States, and examined into our methods. For example, Herr Bark, of the firm above named, sent his son to this country for some years to study the methods

here, and the latter certainly forgot to study the system at home before starting, because he ordered in Worcester, Mass., two American planing machines, and sent them to his father's firm.

We saw these machines started, and will not soon forget the circumstance. The matching was gauged from the rough or underside, the thicknessing was done on the face side, and the fastest feed was fifty five feet per minute. Two or three boards were run through, the belts taken off, and the machines put out into the store shed. We then held opinions about the same that Mr. Long does now, and had been making such machines for a dozen years, but could offer neither suggestion nor reply to Herr Bark's wrath.

These are, with one exception, the only American planing machines we have ever seen in Europe. The exception was an especially-good machine for flooring and general work, sent out from Philadelphia two years later. It came by a mistake, and was offered at all kinds of prices, but was for working the stuff wrong side up, gauged from the bottom, thicknessed from the face, and cast the shavings all over the machine; was "wrong end formost" in fact. It stood in England eight years, then was sent to Australia, and, as we believe, came back from there to the United States in the end. We have good reason to remember this machine, the circumstances cost us about $2,000.

If Mr. Long is a woodworkman, as he undoubtedly is, and will go to a bench, and undertake to plane up a piece by hand on the method of the planing machines he defends, he will arrive at a new light on the subject. First, he will gauge the piece from a rough side, and thickness it; next he will joint and work the edges, not from the side planed, but from the rough side. Then will plane the last side, just enough to smooth it, if there is anything left. Here we will ask what the piece is worth, and what can be done with it when so prepared. Suppose on the contrary he proceeds as we have always done, to first make a "face," then work the edges from that, and finally gauge and thickness. This is precisely the difference in the two methods of planing that are being considered, and until he can find some better reason than this far appears for the "reversed" system, he must admit the error of arrangement in our planing machines as now made.

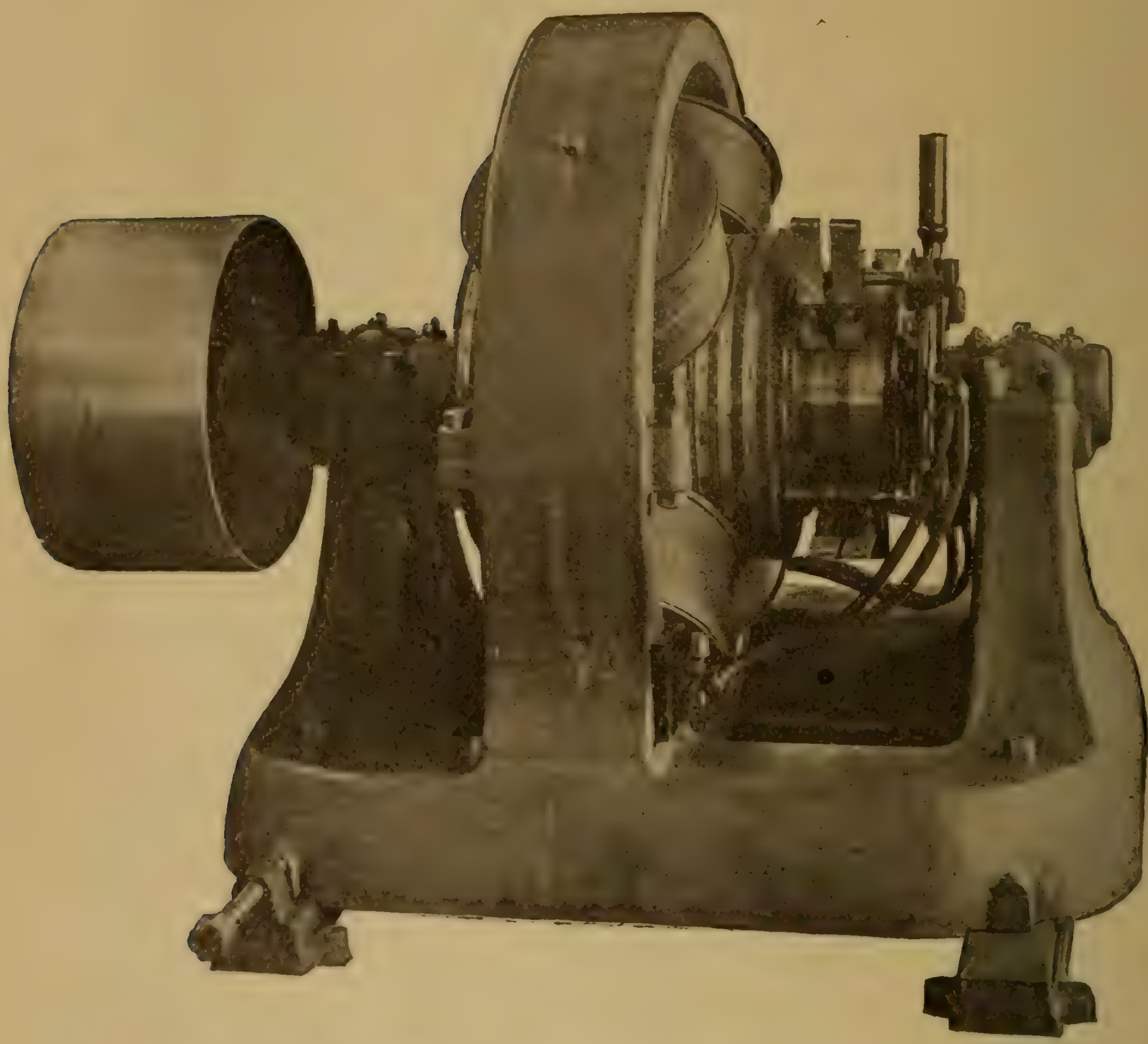
The problem lies here: What is the objection to planing with a machine on the same principle as in hand work, and as all machines are arranged in other countries? This is the point to be answered, and to say that people are satisfied with machines as they are is no

argument whatever. We have not, in twenty years past, met six people who had studied this subject or understood it, and imagine that not one in a thousand has ever thought of it, or knows the difference between American or European machines, hence are satisfied. We are not satisfied, however. No other machines in this country have had more skill expended in their construction. They should be sold all over the world, and would be if made "right end foremost," retaining their other good qualities.

If timber should be thicknessed before a face is made, and the face left rough, if the piece is not full size, and if the edge work should be gauged from the back or bottom, and if a face should be made the last thing, let us have the "reasons" for such an operation. Reasons have been given the other way, and are not replied to, except by the fact that one after another of the makers of planing machines in this country are changing their machines to make a face first thing, and then gauge and thickness from that face. All will do this in the near future, no doubt, and then our machines will find their way all over the world, as they should have done since thirty years ago.

One other matter must be noticed, Mr. Long speaks of the amount of timber to be handled, thereby meaning the speed of performance. In 1872, as now remembered, the maximum feed on American planing and matching machines was 60 feet per minute. At the same date machines made in England, and in the Scandinavian countries, were fed at 90 feet per minute. Other high speeds were fully abreast of us, except when limited by "finish," which is always kept up. We, for many years, exported American machinery to European countries, and while in some places, then as now, woodworking operations were slow, this was not true of the principal centers of this industry.

If the editor of *Woodworker* will procure from some leading Swedish firms one of their catalogues, and reproduce some drawings of joiner work and ready-made houses, a special branch there, it would be a matter of use as well as interest to people in this country.



SLOW-SPEED BELT-DRIVEN DYNAMO.

THE GENERAL ELECTRIC COMPANY.

These four-pole machines, wound for 250 to 500 volts, are made in a variety of sizes, from 4.5 to 60 kilowatt capacity, by the General Electric Company. The slower speed avoids certain losses in belt transmission, the maintenance of bearings, and other vices of high speed. There is also an economy of material, space occupied, and in first cost. The belt speed is less than 50 feet per second, the revolutions being from 550 for the larger machines to 1,050 for the smallest. The bearings of the armature spindle are of very elaborate construction, and serve to remind one of the great change that has taken place in such bearings in five years past. No other portion of a dynamo has been more improved.

LITERATURE.

The New Science Review.

[The Trans-Atlantic Publishing Co., New York and London.]

The trend and scope of serial literature of our time is an enigma. More and more one comes to think it will soon comprehend everything, also that it occupies all, but here in the present publication is marked out a new course, a popular scientific journal without formulæ and without pedantry, dealing with technical matters that concern life.

We were, after the announcement of this journal, looking for something quite different, and, as must be admitted, expected some adventitious feature to bridge over a struggle for recognition, but nothing of the kind, sterling good from the best sources in plain but good dress, and, above all, the warrant of continuance in the same quantity.

No one will conceive, until the matter is brought to mind by a publication like the present, how many o' life's affairs lie within the domain of what we call science. The economy of practical life in all of its phases may be thus included. What it includes is answered in the present number of the *Review* by Mrs. H. O. Ward in a manner we dare to call fascinating. After all, however, science is truth, what can be weighed, measured, demonstrated and proved.

The scheme of the *Review* we conceive to be the popular treatment of studies heretofore classified and treated as technical, to reach beyond the specialist out into the world where the real affairs of life are going on. As an educational instructor its influence will be wide. It is published quarterly, price 50 cents a number.

Locomotive Testing.

Prof. Wm. F. M. Goss, of the Purdue University, Lafayette, Indiana, sends a neatly prepared bulletin describing the locomotive-testing plant at that place. We can only comment on the thoroughness and completeness of the method, and refer our readers to the University or to Prof. Goss for a technical description. The drawings prepared in illustration are the neatest we have seen, in fact the whole make-up of the pamphlet has an air of completeness.

The dynamic quantities, so to speak, in a locomotive cannot well be determined in service where there is no chance of measuring resistances, no constant conditions and, we may say, no opportunity for observation, but when the engine is still, and the ways become the moving element, as in this case, there is every opportunity for exact experiment. They have in a sense "caught a locomotive," tied it up and proceeded to analyze it.

Such tests must, of course, be confined to the steam-generating and steam-applying elements, many of the conditions of actual service are wanting, but it so happens that this last, and most difficult part, is the one that present knowledge is most proficient in.

There is also an account of the restoration of the Purdue University, which was, as our readers will remember, burned a year ago. The engineering department has been much extended.

The Stetefeldt Furnace.

Mr. C. A. Stetefeldt, E. M., of this City, presented at the New Castle (England) meeting of the Federated Institution of Mining Engineers, in September last, a paper on the "Stetefeldt Furnace," that is a model of what such papers should be, but cannot be, for reasons that will be referred to presently.

The Stetefeldt furnaces, introduced first on this Coast twenty-eight years ago, have been from time to time the subject of essays, papers and technical writing, but have never been completely described until the present time in the paper above named.

If the able author could have written this same essay twenty years ago his methods would undoubtedly have had a still wider place in modern metallurgy, but he could not do so, and it is only now, after he has laid off his armor (canvas suit and laboratory implements), and can look back over

the whole field, that the true import, possibilities and limitations of the system can be seen.

It is only after arduous professional duties have ended, and in a leisure given to various philosophical subjects, that he can "construct" and put in true connected form a description that may be likened to Smeaton's paper on the Eddystone lighthouse, and this is as high a compliment as we can think of.

Of the technical merits of the paper we can say nothing, and need not. The author and his works are widely known. His work on metallurgy is now undergoing revision, and the present matter will, no doubt, be incorporated in the new edition. Copies of the paper can be procured from the author at Oakland, Cal.

Report of the Secretary of the Navy for 1894.

This document, sent by courtesy of Past Chief Constructor Theodore D. Wilson, is not extensive considering the department to which it relates, but makes up in this respect by being concise, or, as we may say, "to the point."

Its recommendation of concentrating the administration of the department bureaus, begun by Secretary Whitney, are strong and logical. Opposition comes from within, not from without, and there is hope of a good deal of reform in this way by an increase of responsibilities. Now there are bureaus and bureaus, producing the usual chaos of divided authority. The main impediment is, no doubt, the prejudice between the staff and the line, and involving a good deal of the "Tite Barnacle" methods.

A well deserved tribute is paid to Past Chief Constructor Wilson in respect to designs and computations for the new battle ships, and others. It will be rembered that a committee of investigation, the Walker Board, found serious defects in the computations for stability in the *Machais Castine*, *Detroit*, and *Montgomery*, and certain changes were made, but no such mistakes were found in the battle ships and cruisers, the report being that a variation of only five eighths occurred from the computed meta-centric height in the new vessels designed under Chief Constructor Wilson's administration.

The Secretary recommends that the Coast and Goedetic Survey pass under control of the Hydrographic Office of the department for reasons that do not in any way criticise the work of that bureau, but the force of the suggestion is, as we think, impaired by a proposal to delegate the work in part to the Geological Survey, where we think the plane-table methods practiced on this Coast would hardly compare with work done under Prof. Geo. Davidson's division.

No special recommendation is made under the head of "personal." Congressional action is urged on the lines of the last year's report.

The Secretary has some drastic remarks on attempted frauds in steel castings and in armor plates at the Carnegie Works, and believes no farther deception of the kind is possible. There is no modification of the report on these frauds made last year, which sounds strange in connection with the reported attempt made to have the fines imposed on the Homestead Company remitted.

Public Works.

BY ERNEST M'CULLOUGH.

This is a pamphlet of 54 pages containing various kinds of information useful to the officers of municipal incorporations, and will be a useful reference in a good many things proper for such people to know.

While conceding the importance of using every means of instructing such officers, we must doubt the expediency of a system that delegates legislative functions to anybody less than the government of a State, and also of a system that creates officers to exercise executive functions of the kind by the exigencies of a popular vote, but it exists, and the only way is to make the best of it.

It is obvious that most of the people selected for such functions know about as much of public works as they do of metaphysics, hence, as before said, whatever will afford information is commendable.

In the chapter on streets, the author speaks of a "covering" as a "street," and justifiably too, because it is seldom in this country that anything beyond a covering is provided, the substructure being clay, sand or soft earth. This is part of a street, but only a part, and perhaps all that is to be hoped for. A street covering or face bears

about the same relation to a real street that a roof does to a house. We have no streets yet, and it is quite right to recommend some method of keeping on top of the mire by top coverings until the time or age of streets begins.

Chapter IX relates to "bonds," or to render it in plainer terms, borrowing money on a pledge of the citizens' property, and to be voted for by whoever happens to be sojourning in the place at the time. The author confines his remarks to methods, and the suggestions are no doubt good, but our observations of this matter being mainly in the Southern States, and in border towns of the North and Southwestern States, we think the less information given the better.

Report of the Smithsonian Institution, 1893.

This voluminous document for the year ending July 1893 has been received. Advance sections of it, or of the appendix, have been noticed in these columns during the past year. The matter thus kindly sent by the Secretary, Prof. Langly, comprised the most that can be called popular in the recorded work of this important institution, the only one of its kind having national patronage, or national attention even, in this country.

The appendix to the present report, consisting of 680 pages of matter, embodies the most advanced research and thought in the various fields of science, most striking among which are contributions by Professors Wallace, Walcott and Clarence King.

The paper of most interest, especially to the people of this Coast, is one by the president of the National Geographic Society, Prof. G. G. Hubbard, on "The Relations of Air and Water to Temperature and Life." This paper was presented at the World's Congress in 1893, and we intend at some future time, with the author's permission, to republish it complete in "INDUSTRY." In it can be found some explanation of that complex phenomenon we call "California weather." The following short extract will indicate the drift of Professor Hubbard's paper:

"The currents of wind strike the coast between the fiftieth and fifty-fifth degrees of north latitude, the region of greatest rainfall, and are in part deflected northward and southward by the coast range of mountains, the remaining portion blows over the mountains and up the valley of the Columbia. Continual fogs and rains abound on these shores, and the coasts of Southern Alaska, British Columbia, Washington and Oregon are covered with the densest and largest growth of evergreen forest in the world. These winds prevail as far southward as the latitude of San Francisco, where the southeasterly trade winds commence and blow off shore, leaving Southern California and the western coast of Central America a zone of calms, dry and barren."

Board of Education, Los Angeles, Cal.

REPORT OF 1893-94.

If it were not for the extraordinary and continuous efforts directed to school education in this country, it is a problem as to where we would stand in the scale of civilization. A third of a million of foreign people of diverse nations and races are landed here each year to be with our population spread over an area nearly as large as Europe. These immigrants are to a great extent illiterate, and some of them determined to remain so, others are educated beyond our own standard, but bring with them ideas and methods that do not assimilate, so the problem of schools is as difficult as it is extensive.

California is among the foremost States in this matter, as will appear from the present report. Los Angeles is a city of schools, employing 254 teachers, with an enrollment of little more than 12,000, and a yearly expenditure of $250,000. There are forty school buildings in all, insured for $252,325, and all this with a population of about 60,000. The report is a model in arrangement, and otherwise, consisting of 291 pages, printed and prepared in an exceptional style for such documents.

Books Received.

Proceedings of the International Electrical Congress, August 1893. Published by the American Institute of Electrical Engineers, New York.

Notes on the Year's Naval Progress, July 1894. Office of Naval Intelligence, Washington, D. C.

Local Notes.

Among our exchanges we feel compelled to mention the *Sonoma Democrat*, a journal coming from a small California city, that in all that goes to make up an useful publication the kind has a first place. A local patronage is the most difficult to please and retain. A play can run a hundred nights in a metropolis, but not ten in the provinces, and to instruct, amuse and satisfy the same people continually, indicates merit of no small order. The *Democrat*, it is true, goes wider, and has resources far beyond what is common in journals outside the great cities. The publishers own a completely equipped establishment and all this, but how the matter is made up, is a problem not easy to understand. Santa Rosa is quite a city in numbers, and still more of a city in intelligence, wealth and enviroment; which brings us to the proposition first in mind, that a newspaper is always a gauge and exponent of the kind of people who read it.

The Lake Washington Canal at Seattle, it is now claimed, will be made by private enterprise, and turned over to the Government in six years, which may be doubted. Lake Washington is a considerable body of fresh water, lying about two or three miles inland from Seattle, reached by a cable railway, that was at first constructed according to the ramshackle system, but since improved we are informed. There has been a great deal of effort made to have the Government cut a canal from the Sound back to the Lake, so as to make the latter a fresh water harbor for war vessels and a shipbuilding place. The scheme is no doubt one having a good deal to recommend it, but it will be hard to judge of this from the Seattle standpoint of view. There is an Act of Congress authorizing such a work, but no farther action has taken place. The Lake is higher than the ocean, and locks or sluices will be required. These are projected 300 feet long, 75 feet wide and 22 feet deep, which will not admit large war vessels.

The *Examiner* comments wittily and in a large sense logically, on the "coyote scalp industry" of California, claiming that instead of rescinding the $5.00 premium on the scalps of these animals, there

FULTON

Engineering and Ship Building Works

SUCCESSORS TO { FULTON IRON WORKS HINCKLEY, SPIERS & HAYES / F. A. HUNTINGTON }

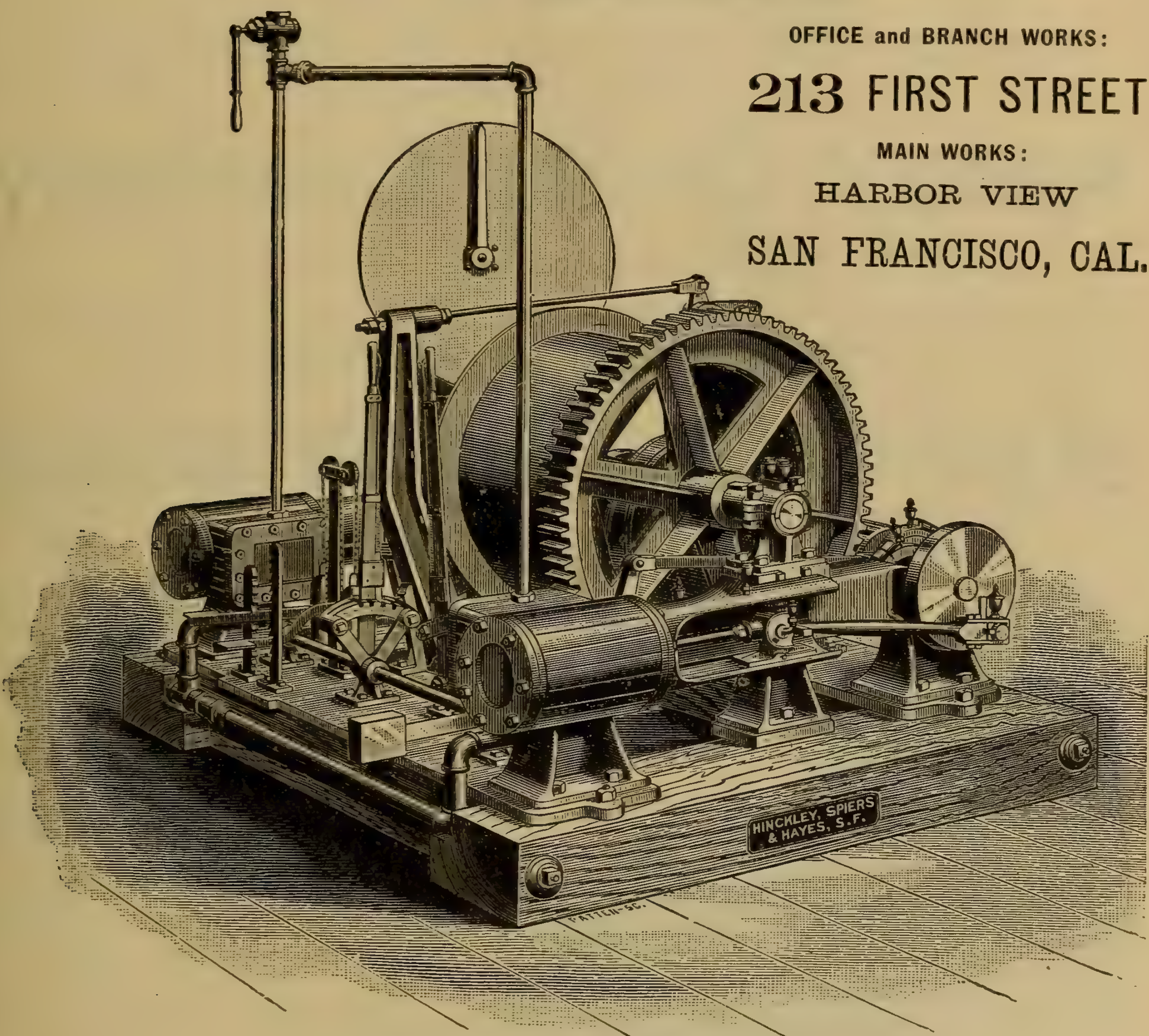
OFFICE and BRANCH WORKS:

213 FIRST STREET

MAIN WORKS:

HARBOR VIEW

SAN FRANCISCO, CAL.



MANUFACTURERS OF

STAMP MILLS
AMALGAMATING PANS
SETTLERS
FURNACES
RETORTS
ROCK BREAKERS
CONCENTRATORS
ORE FEEDERS

STATIONARY ENGINES
Either Plain Slide-Valve, or with Corliss or Meyers' Cut-off.

MARINE ENGINES
Either High Pressure, Compound, Triple, or Quadruple Expansion.

HOISTING WORKS
ORE BUCKETS
WATER BUCKETS
CAGES
MINING CARS

BOILERS OF EVERY DESCRIPTION
FRUE CONCENTRATOR
TUSTIN PULVERIZERS
LLEWELLYN HEATERS
HUNTINGTON ROLLER MILLS

AGENTS FOR THE DEANE STEAM PUMP

should have been an additional sum paid for the tails, so as to more fully apply the principal of "protection," but the wisest thing of all and the truest, are the remarks concerning the incursion of starved coyotes from Arizona and New Mexico, the same as the premium method attracts the pauper element of Europe to this country. It is said that claims paid and demanded for coyote scalps in California, amount to $400,000, and that this proposed blow at the industry is much worse than people imagine, because the scalp of a coyote is worth a good deal more than a sheep, with its fleece thrown in. If values destroyed by the coyote did not constitute an incentive strong enough for his destruction, on what grounds were the scalp premiums given?

The *Iron Trade Review*, Cleveland, Ohio, has published a "trade revival" number of 86 pages, with embellishment, and a mass of interesting matter, connected with the metal and allied interests. It is a hopeful sign, not only in that the *Review* can make this considerable draught upon its resources, but the indication of a revival thus exemplified. We need not trouble our readers with the facts, further than to say that the *Review* is a faithful and comprehensive exponent of the trade, and too conservative to blunder. Out here on this Coast we are looking eastward for the beacon. At the tail end of the country so to speak, this Coast is the last to feel the effects of trade revulsion, also the last to be affected by revival. We welcome the signal.

The description by Mr. E. A. Rix, of the pneumatic guns to be erected here at San Francisco, appearing in another place in this issue, will be of much interest. Mr. Rix, who is preparing plans for the air compressing machinery, sends graphic illustrations of the trials at New York, mentioned in his article, and they are wonderful. There is no time to engrave the diagrams for this issue, but we may say that the alignment of the shots determined from shore marks is perfect, and the radius of explosive action "overlaps," so that the terrible effect covers a "swath" in the water, where nothing could exist. But not necessarily direct, the path of effect is under complete control. Supposing the circumstances to be as here portrayed, it would seem that the science of harbor defense has culminated in these terrible weapons. Let us hope, however, that no actual proof of this will ever be required.

The Union Gas Engine Co., of this City, have removed their works to a more central position on Howard Street, and have fitted up in a manner corresponding to the best practice for such works, that is with a gantry and over-head travelling crane, spanning and serving the erecting floor and heavy machine tools, forming balconies for the lighter work above. The offices and draughting room are on the second floor, the ware room in front below, and the whole an ideal arrangement. The company will find a material reduction in their expense account, and an increase in their productive capacity. It is strange that this country has been the last to recognize and adopt the gantry system, it may be called, for machine work. It saves a third of the floor room, besides avoids risk in handling, inconvenience and expense.

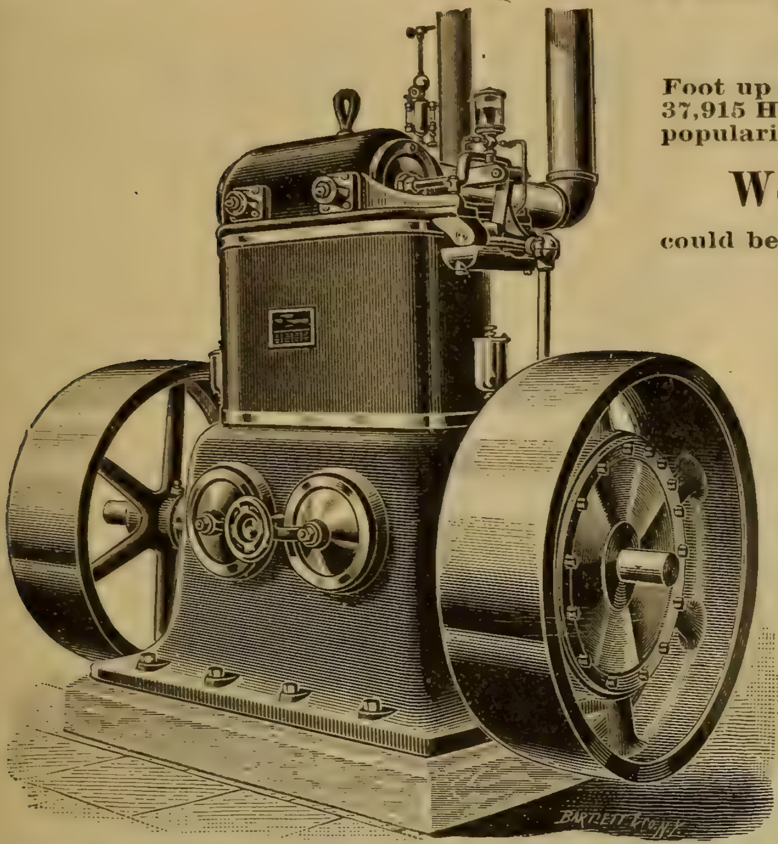
COMMENTS.

The *Engineering Magazine* could have saved unlimited clatter, pots of ink, and reams of paper, by printing some years ago the article of Mr. Henry Dunning McLeod, on coinage. The average and indeed the foremost man is saturated all through with the fifteenth century idea of creating values by law. Only here and there has the light come to a few people, and in them it takes the form of a disgust, such as is felt for superstition. Here in concise form is the history of this money problem, as it has come down through two centuries and more now and then, as by Oresme in France, Copernicus in Germany, Gresham and Smith in England, the natural law, fact and common sense of the matter has been laid down for public guidance, but it did no good. The average citizen clings to the faith that money and values can be made by law, and that coins are some kind of a mysterious thing not amenable to the natural laws of value. This history by Mr. McLeod, published last month, should settle the matter in the minds of all reasoning people.

What Mr. McLeod shows is that for two centuries past, whenever two kinds of coin of different intrinsic value were put in circulation, the better coin at once disappeared. There is no exception and cannot be. Those who can remember thirty-five years ago, saw gold disappear in "one week," and never again show its face for seventeen years. How else can it be. All who have debts to pay will use the least valuable money; the other will

Despite the "Hard Times," **WESTINGHOUSE ENGINE**

SALES FOR 1894



Foot up a total of 270 Engines, aggregating 37,915 H. P. No endorsement of the continued popularity and success of

Westinghouse Engines

could be more emphatic.

THREE TYPES

COVERING EVERY GRADE OF SERVICE

COMPOUND

5 to 1000 H. P.

For Electric Lighting, Electric Railways, and high grade service generally.

STANDARD

5 to 250 H. P.

A high-class Steam Engine for all purposes.

JUNIOR

5 to 75 H. P.

Low in Price and thoroughly reliable.

Catalogue on Application.

THE WESTINGHOUSE MACHINE CO.

PITTSBURGH, PA., U. S. A.

BERLIN LONDON ST. PETERSBURG VIENNA

SIEMENS & HALSKE ELECTRIC COMPANY

Head Office, Chicago, Ill.

Pacific Coast District, 508 California St., S. F. A. E. BROOKE RIDLEY, Agent

---

Yard Telephone No. 67 **Office Telephone No. 5153**

CALIFORNIA

IRON and WRECKING CO.

Successors to HENRY J. ROGERS & CO.

Submarine Contractors, Wreckers and Divers

IMPORTERS AND WHOLESALE DEALERS IN

CAST AND WROUGHT IRON

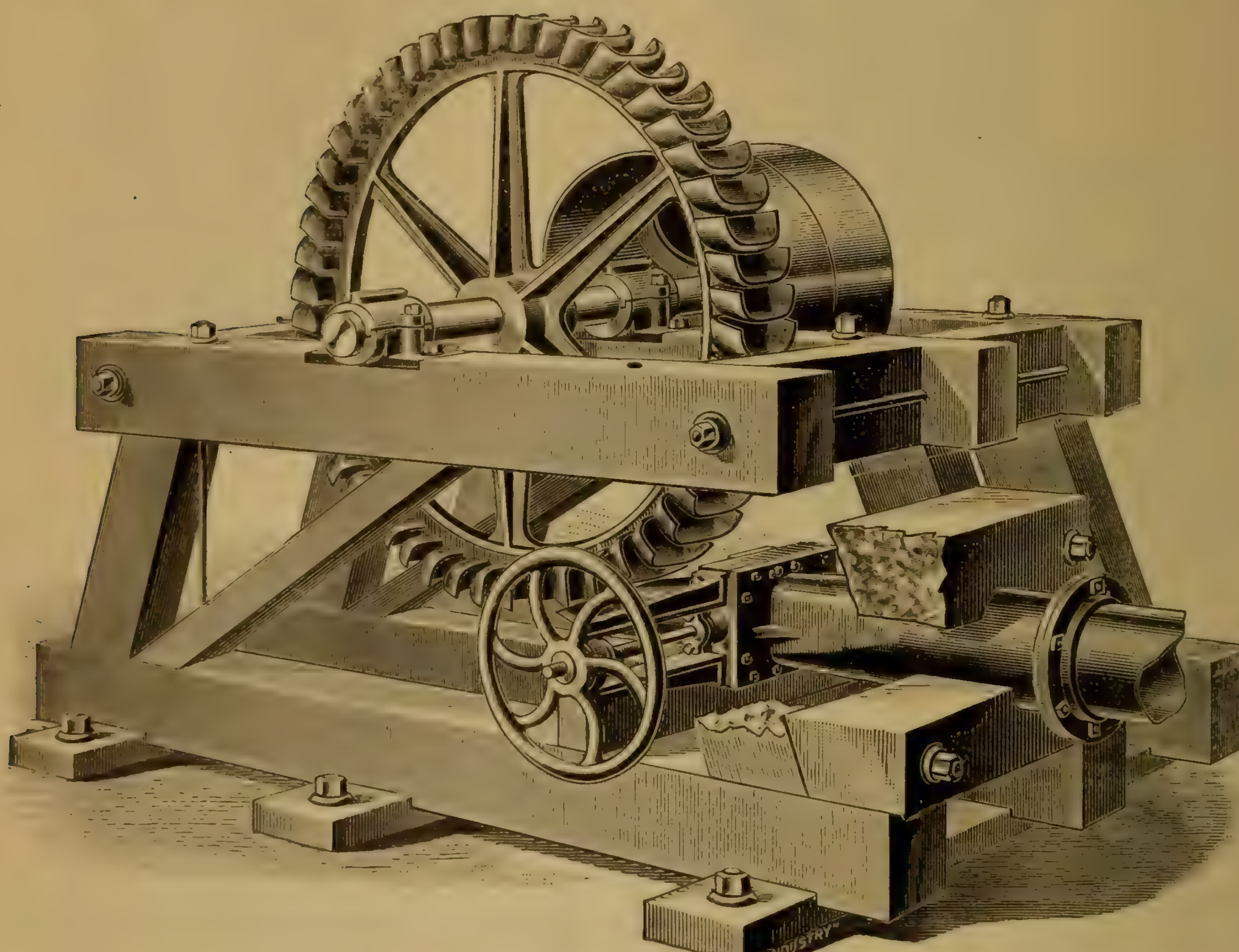
IRON SCRAP, and other METALS,

Second-Hand Machinery and Water Pipe,

Iron for Smelting and Reduction Works

638-640 Second St., San Francisco

THE KNIGHT WATER WHEEL



The drawing above shows one of Knight's Standard Water Wheels, of which there are more than 350 in use in California alone. These wheels are made from 2 feet to 6 feet in diameter, from 10 to 1000 horse power, and adapted to all heads and to all purposes. Their first cost is less than one half as much as pressure turbines, and the expense of maintenance is not one fourth as much. Circulars with full description and particulars sent free.

KNIGHT & CO.

SUTTER CREEK, Amador County, Calif.

N. CLARK & SONS

MANUFACTURERS OF AND DEALERS IN

CAPS AND TOPS

FIRE BRICK AND FIRE CLAY

Water Pipe **Chimney Pipe**

17-19 SPEAR ST., SAN FRANCISCO

be melted down, hoarded or exported, but never paid out. Coins may as now be made of silver, cheaper in value than those of gold, nickel or copper, but they are current because "representing" and convertible to gold in small sums, just the same as a note or obligation known to be good and convertible. Constitute silver a coin of definite legal value by law, and no more gold will be seen. This is the "Gresham law," laid down or rather restated in Queen Elizabeth's time, proved by every event in money history, and obvious without history of any kind.

The engineering reputation of De Lesseps was an accident, also a myth. No one, now that he is gone under a sorrowful end, will attempt to detract from his eminent capabilities, but he was no engineer, and hence fell a prey to schemes that took advantage of this fact. Enthusiasm, or *eclat* as our French friends would say, is not a natural element of engineering procedure. It is a solemn kind of business, confined to figures and facts. The Paris convention at which the Panama Canal project was to be considered, compressed its labors into two resolutions, namely, First: that "the Canal be made." Second: "that it be a thorough cut." This indicates what we are contending for, that the methods of De Lesseps were not those of an engineer in the inception of the Panama scheme, and certainly were not so in the work as it was afterwards carried on.

Mr. Frederick Harrison has done himself the honor of assigning Charles Dickens "a place in modern literature." It is kind, but uncalled for. Dicken's writings have taken their place long ago, and people are well aware of what it is. Any dictum or even opinion in respect to a writer's place in literature is mere assumption. Literature for whom? Is the question. There is but one gauge, and that is the publisher's account books. There is not in all of Dicken's writings, letters or otherwise, any claim of his in respect to a "place in literature," and the pity is he did not find opportunity to draw a picture of a censorship, such as set up by Mr. Harrison. If he had done so, there would have been writhing and wrath. Dickens punctured the bubble of modern sham, cruelty and ignorance, dipping first his probe in the anæsthetic of humor, pathos and sympathy. His place in literature did not concern himself, and much less his readers.

"Jim Hill," who violated the ethics of American railway construction by building a trans-continental line without government land or subsidy, and without stealing the capital, has for some time past had an eye on this end of his route, with a steamer connection to San Francisco, and no one need be surprised if such a scheme is carried out when his lake line is completed and successful. If President Hill is able to continue in his course as an upright man, which all hope, his works will become a great factor in checking the present methods of the great carrying corporations. He has the ability, aud also the power, to force the trans-continental business to fairness, and to a basis of capitalization bearing some proportion to the real investment. The whole questions turns on his individuality, and whether he prizes more the money of extortion, or the good opinion of his countrymen.

There are evidences in England that the trades unions have overshot the mark, and caused a reaction that may in time dissolve the system, unless it is modified. There is a National Free Labor Association that rebels against the protective ideas set forth in the late manifesto of the Norwich Congress of the trades unions, at which resolutions in favor of socialism with other heresies were passed. There is close affinity between trades unions, protection and socialism, the three are but parts of a whole directed to curbing individual liberty, and now that a reaction has set in there will be less tolerance in future of the protective idea among workmen. The members of the unions are estimated at only eleven per cent. of the workmen in the country. The National Free Labor Association has among seamen alone a membership of 228,000.

Mr. Robert M. Fenwick, of Washington, D. C., who has for more than thirty years been engaged in prosecuting patent business in the Bureau and in the courts, has in a recent essay on the subject of procedure offered some very logical suggestions, one of which is that the Examiners in Chief be constituted a court or authority of final appeal, the Commissioner of Patents acting with the Examiners in Chief in important cases. The present law permits three appeals, one to the Examiners in Chief, next to the Commissioner in person, and third to the Appellate Court of the District of Columbia. The third and last appeal is illogical. The Commissioner in person is not able to and cannot be expected to act in a judicial capacity.

His functions are those of administration, and are quite enough in that direction. The third appeal removes a case from the Patent-Office to another department of the Government, and for that and other reasons seems an unnecessary part of what is called procedure. Such appeal could be taken in any case under the general law, if an applicant thought there were grounds for a complaint. We hope to find space before long to publish some part or all of Mr. Fenwick's article.

The Post Master General has directed that registered letters sent through the American mails to the "International Patentees Agency" in London, be returned to the senders. This concern, operated by W. K. Munns, Percy Willis and Henry Martin, has been denounced as a fraud, and is but one of many. European patent agencies not known and not confirmed in some way are to be avoided in all cases, especially those on the Continent. They do not last long is one blessing. The law soon deals with them when evidence is obtained, but this is not always easy, and a harvest is gathered before detection. The patent bureaus of all countries being a branch of government, owe special protection to applicants, and swindling operations should be proceeded against and punished the same as in the case of the mail service.

"It.is a question of considerable doubt if William Woodworth, the pioneer of wood-working machinery in this country, would have spent days of unremitting toil and sleepless nights in the study and development of his valuable invention."

This is a quotation from the *American Miller*, and is "bosh." Woodworth was shrewd enough to patent a combination of feeding rollers, and a revolving cutter head or cylinder head as it is called, both old devices, and so laid the foundation of sixty-five law suits. The first judge decided in his favor, and the rest by the ethics of the proffession followed. One suit would have been enough, if the justness of the decision had been apparent. Let the *Miller* change to this: "Woodworth delayed and hindered wood-working enterprise in this country for thirty years, by a trick rather than invention, and by virture of a patent that would not have stood one day if there had been the knowledge of preceding practice that exists now." The Woodworth patent was the greatest misfortune the wood-working art ever had to contend with in this country.

It is a great pity that William Penn, in addition to drawing a charter for Philadelphia, did not go on and make a code for the rest of the country. He discovered two centuries before Henry George, that public taxes should be assessed on land, and not on improvements, implements, manufactures and commerce, and thereby founded a great city where a poor man can own his home, and does so, three to one over any other large city in the world. He also discovered that the water front of a city does not belong to a front line of lots, or to any person or corporation, and thus wrote of the matter in 1684:

"The bank is a top common, from end to end. The rest next the water, belongs to *front lot* men no more than *back lot* men. The way bounds them. They may build stairs, and at the *top of the bank, a common exchange, or walk*, and against the street common wharfs may be built freely; but unto the water, and the shore, is no purchasers."

The Australian system of voting, as now adopted in this and other States, has a serious fault that may defeat its objects in that it supposes an honesty and intelligence in judges, inspectors and clerks that does not exist, and cannot very well be provided. In New York City it is claimed that three fourths of all the election officers were incompetent, and the same thing may be said of San Francisco, because it is not now known which of several candidates for City offices were elected in November. The "rigmarole" of the matter may be learned in time, so that a common laborer, drayman or bar-keeper may perform the functions of an election officer, but we doubt it. The enormous fine that may be imposed for failing to serve indicates that intelligent and educated people are expected to be selected, but they are not, as can be plainly seen.

How not to do it seems an inherent element in the consideration of the Nicaragua Canal matter in Congress. There is no doubt of the expediency of the work, not much doubt of its feasibilty at about twice the estimates, and no doubt whatever that the people want it done. The problem is how can it be done so as to enrich a few private persons, and yet be within the semblance of honesty. Can the work be done in both public and private interest? That is the problem. Can any national matter be dealt with at this day, independent of that omnipresent element, we term the "person?"

Bonds to the amount of 200 millions could at any time be issued against the work, if it is wholly a government undertaking. No one can question this, but it is the "Credit Mobillier" "Contract and Finance" schemes that "lie" in the way, and will do so for a generation to come. People have lost confidence.

The *Engineer*, London, contains in the issue for December 14th, No. 2,033, about 2,300 square inches or 16 square feet of original engravings, besides a large sheet of litho tracings. The engravings alone must have cost not less than $1,200. There are 40 pages of matter, 9 × 15 inches, three colums to a page, or 120 in all, which at the regular rate may be set down at $600, and 50 per cent. for extras and incidentals, so the "make up" will be over $2,000; composition, press and paper will be as much more. To pay for this, are about 100 pages of advertisements, containing 13,500 inches of area, for which the rate is ten shillings an inch, and with all allowances $250 a page, or $25,000 for the issue named. What this property is worth we do not know, but some enormous sum. No. 2,033 means that many weeks, which divided by 52, gives an age of more than 39 years. "Price sixpence," which would purchase about a fourth of the paper printed on. Such a technical journal as this, indicates a wonderful industrial activity in the country.

The great pother in New York over a reform or exposure of the police system, reminds one of hauling a toboggan up a hill to see it slide down again. We have seen the same thing before. It is a treatment of symptons, not of causes, and relapse is easier than the original descent to corruption. We have recently heard a discussion respecting the purchase of the highest officers in the gift of the Government, talked of the same as merchandise; the purchase of a Senatorship for money by bribes to and from venal men, treated seriously and as a matter of course. Who after this can expect an honest police system in New York or anywhere else? The fault lies in universal suffrage and the representative system. If the venal officers in New York are no worse than the voting system that gave them place, they are only "representative," who can find fault?

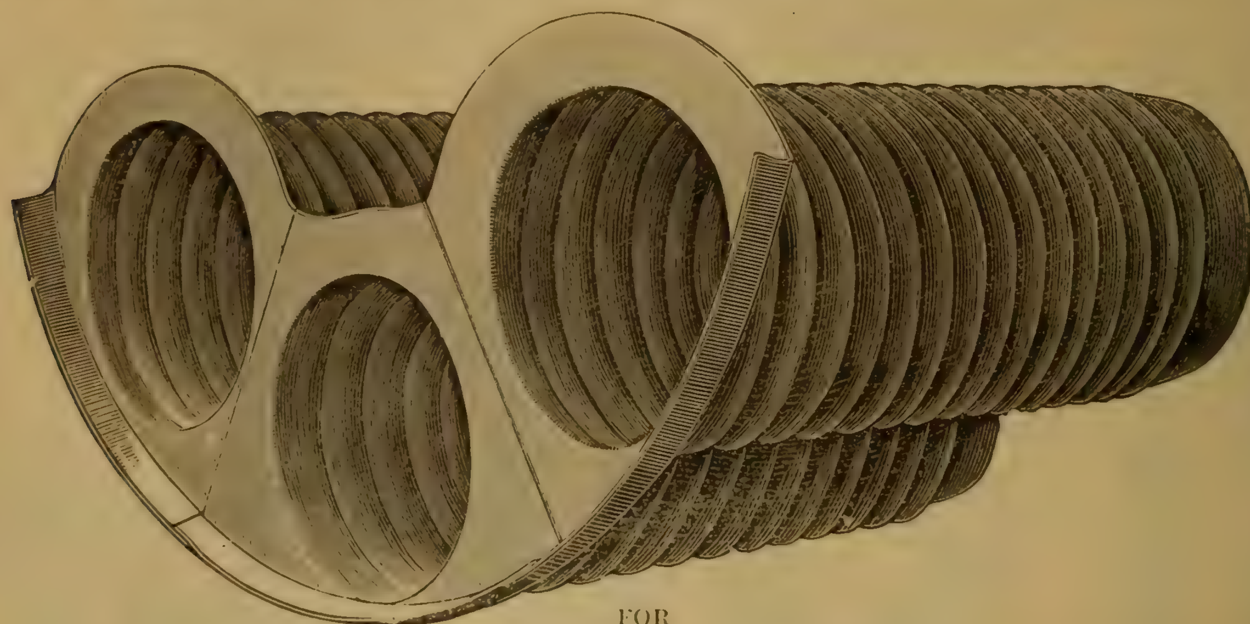
The Bethlehem Iron Works announce that their proposal to furnish armor plates for two Russian battle-ships, the *Petropavlosk* and *Sevastapol*, has been accepted by the Russian Government. This is gratifying to every one, and a compliment to this enterprising company for their good faith, honest efforts and skill, but the strangest construction of the circumstances we find in some of our contemporaries that think the fines imposed on the Carnegie Company by our own Government should be remitted, because the Bethlehem Company have secured a foreign order. The connection is hard to see. The last named company have not furnished any defective work, and if they had, it is not likely they would have secured the Russian contract. It is not likely to be the last of the kind, or the only one the company will receive. English, French and German makers were bidders for the same plates.

Engineering Notes.

The Johnson Company, of Johnstown, Pa., makers of railway bars, and other wrought-iron work, have, like the patriotic Mr. Carnegie, gone to England for implements to be used in their works, and have contracted with Messrs. Galloway & Co., at Manchester, for a pair of rolling-mill engines. The larger engine is 55 inches bore, 60 inches stroke, crank shaft 22½ inches diameter, total weight 300 tons. The smaller engine is 48 inches bore, 50 inches stroke, with a shaft 19½ inches diameter; both to operate under 150 pounds of steam. Mr. Johnson, himself the chief officer, has perhaps found some difficulty in contracting here under a guarantee for rolling-mill engines of such large size, and being a free trader is not inconsistent in purchasing them where they could be best obtained, but Mr. Carnegie has had no such excuse in a good deal of the equipment he has bought abroad. The Galloways make a specialty of such engines, but the order could no doubt have been filled in this country just as well.

We have always, in the absence of an explanation of the methods of observation, doubted the celebrated 999 performance last year, when a locomotive speed of 112 miles an hour was claimed. It does not make much difference if it is true or not, but some criticisms on the methods of measuring the rate, by Mr. C. R. Marten, published in the *Engineer*, London, throw a good deal of doubt upon

CORRUGATED FURNACES



FOR

MARINE and LAND BOILERS

Made in sizes from 28 in. to 60 in. diameter, with FLANGED OR PLAIN ENDS.

THE CONTINENTAL IRON WORKS

BROOKLYN, NEW YORK.

THOS. F. ROWLAND, President.
THOS. F. ROWLAND, Jr. Treasurer

WARREN E. HILL.
CHAS. H. CORBETT, } Vice-Presidents

Take East 10th or 23d Street Ferries from New York to Greenpoint.

INCORPORATED 1866

Insures against
Damage to Property,
Loss of Life, and
Personal Injury
CAUSED BY
STEAM BOILER
EXPLOSIONS

CHARTER PERPETUAL

J. B. PIERCE, Secretary
J. M. ALLEN, President

ABSTRACT OF STATEMENT
JAN. 1, 1894

Cash Capital,	$500,000.00
Total Assets,	1,862,501.25
Surplus as to Policy-Holders,	623,287.95

PACIFIC COAST DEPARTMENT

MANN & WILSON, General Agents

J. B. WARNER, Chief Inspector

306 Sansome Street, - San Francisco, Cal.

the 112 miles statement. He has been timing with careful apparatus the speed of various trains, among them those drawn by the engine 999, and finds no such results. The extreme reached on English railways was 84 miles an hour, but the limit he sets at about 80 miles an hour. He employed chronographs and watches, and had the distances or land marks verified. He estimates, from some observations made by two different engineers who timed the 999, that the speed attained was about one third less, or about 75 miles an hour, but this is, no doubt, wrong. The fact is, however, that until unmistakable means are employed to determine speed the reports do not mean much.

The progress of gas engines toward all kinds of duty is indicated by Messrs. Crossley Bros., of Manchester, England, makers of the Otto gas engines, contracting for a centrifugal pumping plant for a dock at Sunderland, where the work exceeds 30,000 gallons per minute. There will be three pumps, each having an engine directly attached and capable of lifting 10,000 gallons per minute, or, as the contract reads, 14,300 tons of water in two hours. The gas is to be taken from the town supply at Sunderland. The head is, of course, variable, with an average of perhaps twelve feet. The arrangement of the engine is not announced, but it is likely there will be two cylinders for each pump, because a four-cycle impulse would be too irregular for pumping, except where enormous fly-wheels were employed.

We notice, by an advertisement sent to "INDUSTRY," that Smith's Pattern Works, at Akron, Ohio, are making for the trade, leather fillets for machine patterns. The circumstance recalls the subject often discussed here of how long it required even a simple thing of high utility to make its way in the world. It is thirteen years since we first saw this invention. It was that long ago introduced in the Great Cornwall Iron Works, at Birmingham, England, and the owners, Messrs. Tangye Bros., were so impressed with the value of this system for fillets, and the saving effected by its use, that they took up the manufacture, and added it to their list of engineering supplies. We have met with it at later times moving slowly, and now it has reached San Francisco, and is in use at several of the works here. We do not know if it is moving eastward or westward, but it will "get around" in time, and deserves to, as it seems to be a most useful expedient.

The Lancashire, or internally-fired boilers, employed generally for stationary purposes in England, such as are made in this country by the Edgemoor Iron Works, at Wilmington, Delaware, have been put in competition with a water-tube boiler of the best class under the auspices of the Manchester Steam-Users Association, and a memorandum issued by that body claims that the results obtained were no better with the water-tube boiler, leaving unbalanced the great difference in the steadiness of water and steam, durability and safety even. The greater success of water-tube boilers in this country is owing in a measure to the fact that we do not use shell boilers of a high grade, because of their expense. A Lancashire boiler taken per horse power, with the usual allowances of steam and water room, must cost nearly twice as much as a common tubulous boiler.

A good many people are getting impatient waiting for Mr. Tesla's engine, the "vibrator" consisting of the core of a steam engine and the core of a dynamo, as some one has aptly described it. There is an air of plausibility in this thing. In another place in this issue is an essay on impulse action of steam, showing the absurdity in a theoretical sense of employing the pressure of a fluid at the rate of 500 to 800 feet per minute that will flow 4,500 to 5,000 feet per minute. The limitation is in reciprocating motion, cranks and the mechanism of transmission. An engine should move at 2,000 to 3,000 feet per minute, and Mr. Tesla's is a step in this direction, but not very far, because he too has reciprocation and alternating action of the steam.

Locomotive Engineering says the trains of the Reading Railway, between Philadelphia and Atlantic City on the coast, are the fastest in the world, and if so the Reading Company must have concentrated most of their speed on that division. Six to seven cars make up a train of over 400 tons, and the rate last summer was 59.1 miles an hour between terminals. The engines employed are of the Vauclain compound type, with driving wheels seven feet diameter. This requires about 236 revolutions per minute, and with a stroke of 24 inches is 944 feet per minute piston speed, which is after all not excessive. The Buckeye Engine Company, twenty years ago, made engines of 30 inches bore to run at 900 feet per minute, and the rate of revolution is only half what it is in some marine engines at this day, still it is fast.

F. L. BASSETT
Civil Engineer
CONSULTING ENGINEER OF MUNICIPAL WORKS
SPECIALTY:
WATERWORKS AND SURVEYS
Sacramento, Cal.

GEORGE P. LOW
CONSULTING ELECTRICAL ENGINEER
303 California Street, S. F.

C. W. PENNINGTON & SONS' STEEL WORKS
MANUFACTURERS OF
Best Refined Cast Tool Steel. Machinery and Hammer Steel, Steel Piston Rods, Steamboat Shafts, Dredger Buckets, Shear Blades, Lathe Spindles, and all kinds of Steel Forgings made to order.
Office and Works:
218-220 Folsom St. S. F. Cal.

O. Rolfson. R. F. Rolfson.
ROLFSON BROS.
423 Bay Street
Inventors will find it to their advantage to consult Mr. R. J. ROLFSON.
Draughtsmen, Model Makers and Machinists.

LEPPIEN COLLECTION AGENCY
LAW COLLECTIONS
Room I. 110 SUTTER STREET.
SAN FRANCISCO

A. E. CHODZKO
MECHANICAL ENGINEER
Air Machinery a Specialty
15 Fremont Street, San Francisco
P. O. Box 1914

C. T. CLEVE W. H. REED
REED & CLEVE
PATTERN MAKERS
Patterns and Models of Every Description. **Machine Patterns a Specialty.** Drawings and Estimates Furnished. All work done with neatness and dispatch. **Telephone No. 5108.**
225 First St. San Francisco.

OTTO VON GELDERN
M. Am. Soc. C. E.
CIVIL ENGINEER
Surveys and Estimates for Engineering Work, River and Harbor Hydrography and Marine Surveys a Specialty.
ROOM 56, ACADEMY OF SCIENCES
819 Market St., S. F.

Mechanical Drawing

Mechanics, Electricity, Architecture, Architectural Drawing and Designing, Masonry, Carpentry and Joinery, Ornamental and Structural Iron Work, Steam Engineering (Stationary, Locomotive or Marine), Railroad Engineering, Bridge Engineering, Municipal Engineering, Plumbing and Heating, Mining, Prospecting and the English Branches.

The courses commence with addition in Arithmetic, so that to enroll it is only necessary to know how to read and write. A Scholarship entitles the holder to tuition until he is qualified to receive the diploma, no matter how long it may take, nor how often it may be necessary to review. Students can interrupt their studies, and change their residences. Scholarships are not forfeited upon failure to pay installments promptly. Each student is a class by himself, and has the advantage of individual direction by a competent instructor. Students make rapid progress in learning to draw and letter. Specially prepared Instruction and Question Papers, Condensed, Simplified. The Steam Engineering course is intended to qualify engineers to secure Licenses. All representations may be relied upon. Send for Free Circular, stating the subject you wish to study, to

The International Correspondence Schools, Scranton, Pa.

TAUGHT BY MAIL
THOROUGH
PRACTICAL
TRADE MARK REGISTERED.

We have waited for some rational explanation of the explosion in November last of twenty-seven steam boilers in one battery at Shamoken, Pa. They were cylinder boilers, 43 feet long, 34 inches diameter, worked at a pressure of 100 pounds of steam. The explosion began at one end of the row, and fifteen boilers went in regular succession, then nine boilers were skipped, and the remaining twelve followed the fifteen. This circumstance should furnish an opportunity for interesting research, not made so far as we know. One theory, and a plausible one, advanced by an engineer in the vicinity is that the first boiler was thrown up by the explosion of furnace gases, such as are generated in burning culm, and that this broke the steam connecting pipe, 12 inches in diameter, lowering instantly the pressure in the other boilers, so the water they contained flashed into steam. This lowering of pressure is a common feature of nearly all boiler explosions.

ELECTRICITY.

NOTES.

A French Electric Journal has the following results of carefully-kept records of the input and output of accumulators in constant use at the Clitchy Station in Paris.

"The battery consists of two sets of 250 cells each; the total weight of plates in a cell is 330 pounds, the normal output 250 ampéres, and the corresponding capacity 2,000 ampére-hours; the necessary increase in voltage for charging being obtained by means of a separate dynamo. A table is given containing the monthly charges and discharges in watt-hours, and the efficiency for each month, the mean of which is 69 per cent."

Some time ago, we complained of the method in which machine tool makers attempted to connect motors to machines, instead of including the motors as an integral part of the design, and making the whole symmetrical in appearance. This complaint is answered by a circular received from the Siemans & Halske Company, of Chicago, showing various tools in their works, arranged with electric motors, also a view of two departments in their works, one in which the machines are driven by shafting and bands, and the other by electric motors. The difference is striking, in one case the whole overhead space is a maze of belts, shafts, shifters, and other

tackle, with no chance whatever for overhead handling tackle. In the other case, all clear, cranes can pass over every machine, and work be moved about all over the place. There is evidence in most cases of the motors being "patched on," but this was of course unavoidable.

The electric locomotives for the underground connecting lines across Baltimore are nearing completion, so also other parts of the plant, devised about two years ago. There are several of these engines or motors, the largest weighing ninety-five tons, or 19,000 pounds, arranged to be driven at 30 miles an hour in regular service, but with power to haul a heavy train at 50 miles an hour. The General Electric Company, who are constructing these engines, have created some amusement by putting one truck, that is one half of an electric locomotive, on the ways at Schenectedy, N. Y., to pull against a steam locomotive, a kind of "tug of war" contest in which the electric truck was the victor. Baltimore lies directly in the path between the commercial and political centers of the country, Washington and New York. Trains cannot go around or through the city, but must go under it, and the electric locomotives are for this service. Formerly, as older people will remember, the trains were drawn by horses across Baltimore, from Calvert to the Washington Station. The Pennsylvania Company first got "around" Baltimore by tunnels, miles in length, and now the Baltimore and Ohio Company are to do a like feat, employing the electric locomotives described.

A school, conducted by the *Scientific Machinist* Company, at Cleveland, Ohio, is organized to teach the electric arts, and practical work therein, on the correspondence system, and furnishes, heretofore and now, free to the students enrolled in the school, experimental apparatus required in their studies, but this will after a while be charged for at about half price, and, we presume, with the privilege of return at some other or the same rate if the student does not want to retain it, this, however, will not often be the case as the studies require the winding of dynamos and other exercises that will at the end constitute the apparatus in part and the work of the learner. Considering that the practical part of electrical studies can be prosecuted as well with small as large apparatus this correspondence method seems especially suitable, and much instruction given for a small fee.

The storage battery companies have concluded to quit law suits, and form a "combination," which is justifiable if ever such an alliance has been. A large share of the storage procedure this far has been in the law courts, and the public have to foot the bills the same as they will any advance in price by the combination. The new company is organized in New Jersey, and has a nominal capital of $10,000,000, and is called the "Electric Storage Battery Company. There was little reason at any time for controversy over storage inventions. The issues were trivial, relating to constructive features, a kind of game of terms, so to speak. The whole system in all essential features was completed by Faure, and if no farther patents had been granted the art would under commercial competition have advanced much faster than it has. Most of the late patents were for "evasion" only.

If the makers of electrical machinery keep on increasing the size of dynamos, they will before long catch up to Mr. Ferranti's enormous Deptford machine. The General Electric Company are now making one of 800 kilowatt capacity, or over 1,000 horse power, for use at St. Louis, Mo. There are 80 poles, and an armature 16 feet in diameter, weighing 100,000 pounds, mounted on a shaft 22 inches in diameter. The machine weighs 70,000 pounds, and is 24 feet in extreme dimensions. The speed is only 90 revolutions per minute, and this leads us to the remark that there seems to be a general tendency to lower speeds of revolution throughout. High speed for dynamos is something like high speed for other things, saves a little in the original investment, to be made up in maintainance under less satisfactory use afterwards. We allude especially to bearings and transmitting gearing.

There is employed to some extent in Germany, a method of preparing the active material for the electrodes or plates of accumulator batteries, that seems to attain a much better result than is common with plastic peroxide, as it is commonly applied. Lead is ground fine and mixed with some porous substance, such as slag, cork, wood or pumice stone, and then applied after moistening. The last mentioned substance is no doubt the only one used, but the description being from a translation from German, is of the usual redundant nature, that after a column or two, leaves the reader in some doubt as to what the subject is. In expanding, the per-

oxide of lead is forced into the interstices or pores of the pumice stone, and thus is avoided the disturbing action that warps the plates. These accumulator batteries have been in use in Germany since 1891, and are now being introduced in England.

The American Institute of Electrical Engineers have taken unto themselves a new habitation, more central, and, no doubt, with other "furtherances." They are now in the Havemeyer Building, 26 Cortlandt Street, New York. Among the technical associations of this country perhaps no other shows so much vigor, or is so successful, in the aims to which such societies are directed. The art is new, the men are most of them young, and spurred on by emulation, but the main thing is the interest of continual change and advancement. There is something new for each meeting, and, above all, there is an uniformity of education and technical qualifications that contributes no little to success. The Secretary, who is really the administrative officer, except in sessions, is well chosen, a man of high ability and an accomplished professional reputation.

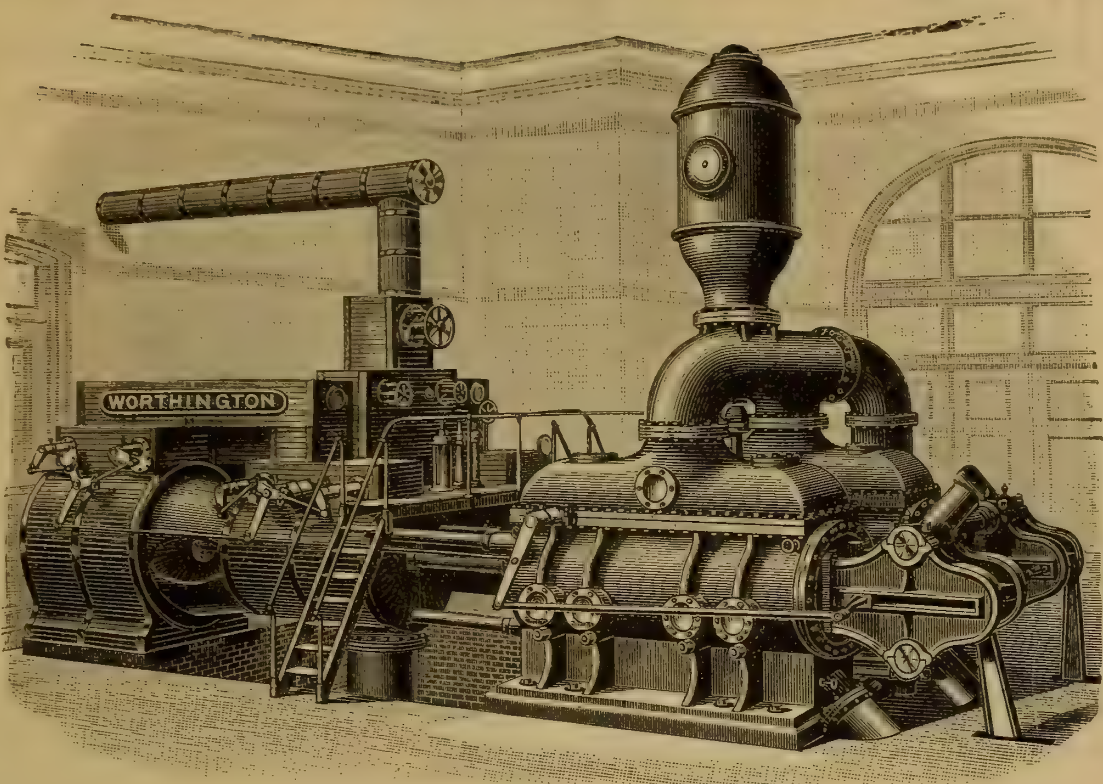
MINING.

NOTES.

Judge Sawyer's decision that the land grants to the Northern Pacific Railway, which specifically excluded mineral lands, was a vile sophistry. "By the word 'mineral lands,'" said he, "must be understood lands known to be mineral at the time the grant was made." Leaving out all analogy to the fact that mineral lands are not patented in the case of purchase by others for agricultural uses, what is to be done with the fact that when this grant was made no one knew what was contained in this 40,000,000 acres of wilderness. It was unexplored in respect to minerals, and there is no one, not even a child, that does not know that the above-named decision was wrong, and not law. The road was not built for ten years, nor until the country was settled without the railway, and the grant was forfeited by lapse of time in complying with their obligations. Millions of wealth were thus given away to a combination of men who have never done much else than manipulate such schemes.

WORTHINGTON HIGH DUTY PUMPING ENGINES

THESE HIGH DUTY PUMPING ENGINES Have been adopted by the World's Fair Commission to supply all buildings and grounds of Columbian Exposition, Chicago 1893.



THE CONTRACT CAPACITY of **Worthington Pumping Engines** for Water Works alone to Jan. 1, 1892, **2,585,000,000** Gallons daily, which would afford a stream of water 12 hours per day, 400 feet wide, 5 feet deep, with a current 3.4 miles per hour.

Pumps for all purposes and for any pressure to 8,000 pounds per square inch. The pumps in the Mills Building, Crocker Building, Chronicle Building, Donohue Building, Union Foundry Block, First National Bank Building, Telephone Building, Lick House, Occidental Hotel, and many others in San Francisco, are Worthington.

A. L. FISH, AGENT, 59 AND 61 FIRST ST., S. F.

ALSO AGENT FOR THE

AMERICAN FIRE ENGINE Co., which includes Clapp & Jones, Silsby, Ahrens & Button Engines

DANIEL BEST'S GAS ENGINE, Superior to any other in the market

BUCKEYE AUTOMATIC CUT-OFF ENGINES, of Salem, Ohio

CURTIS' STEAM AND WATER PRESSURE REGULATORS

NATIONAL WATER PURIFYING CO.'S FILTERS

Water and Gas Works' Converse Patent Lock-Joint

PIPE

Extensively used in Cities and Towns on the Pacific Coast, for Heavy Pressure, Durability, Economy.

Gates, Fire Hydrants, and Full Supply Pipe Fittings and Tools

DUNHAM, CARRIGAN & HAYDEN CO.

AGENTS

17 and 19 Beale Street 18 to 24 Main Street

SAN FRANCISCO.

New extracting processes for gold and silver come around with as much regularity as "new strikes of ore," and last about as long. The latest is from Denver, and takes $26.40 per ton out of ore that by old methods yielded only $14.00. The process is protected by nine patents, which can be looked up and examined by anyone curious in such things. The inventor is called Captain Bradford, which will give a clue to find the patents by. We happen to know a skilled mining engineer and metallurgist of great experience, to whom it was the custom for a long time to send announcements of new "extracting processes." His manner became so violent that the notices were discontinued. At first they came back with a marginal note or two, half respectful, then with terms of contempt, next crossed out with a blue pencil, winding up with expletives that a moral journal like this cannot print.

The town of Plymouth, in Amador County, must be a famous place for real estate speculators. It is first up, and then down, as the great mines there are worked or otherwise. Now the town has entered upon what may be regarded as permanent prosperity, because the mines situated on the Mother Lode are among the most stable that exist anywhere in the country. Five years ago we visited the mines thereabout, and while not understanding anything of the subject on its merits, there was this general fact, that the mines had most of them paid until closed down a dozen years ago, and this was quite enough. If the cost of labor, machinery and fuel at that time, also the imperfect methods of extraction, are compared with what exists now, it should leave a margin of 50 per cent. over the old product. This has been proved as we believe, in the case of all the mines reopened, and the Amador district is again a permanently prosperous one.

The new proposition of depositing or saving the metal volatilized and carried off in the fumes of smelting furnaces, is not likely to result in much gain, if a flue five hundred yards long and six thousand square yards of filtering area are required, as reported in one case. Some more simple means of filtering the smoke will no doubt be invented. A foreign contemporary suggests that Prof. Lodge's method of electric deposition from smoke might do. It seems plausible, but at any rate very few flues 1,500 feet long and

six thousand yards of filtering chambers will be constructed. The Omaha Works have been fitted up in this manner, but no continued result has been this far published. Filtering means passing the smoke through a fabric of some kind, with which a great chamber is lined.

Mr. Louis Janin, Jr., of this City, is now visiting the Australian mining districts, with a view of determining whether American machinery and methods can be profitably introduced there. He will visit Victoria first, and afterwards Western Australia, and before his return go to the South African mining districts. Some of our contemporaries speak of antiquated methods in Australia, but this in so far as machinery for crushing and concentrating, and amalgamating, is no doubt a mistake, and we suspect that Mr. Janin has in view other processes than these. The Janin brothers about two years ago prepared a new process of extraction, that a good deal was said about at the time, and some experiments tried, but with what results we do not know. A visit of the kind to Australia will result in good no doubt. There are by far too few such visits by people from this country.

No. 80. MARCH, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

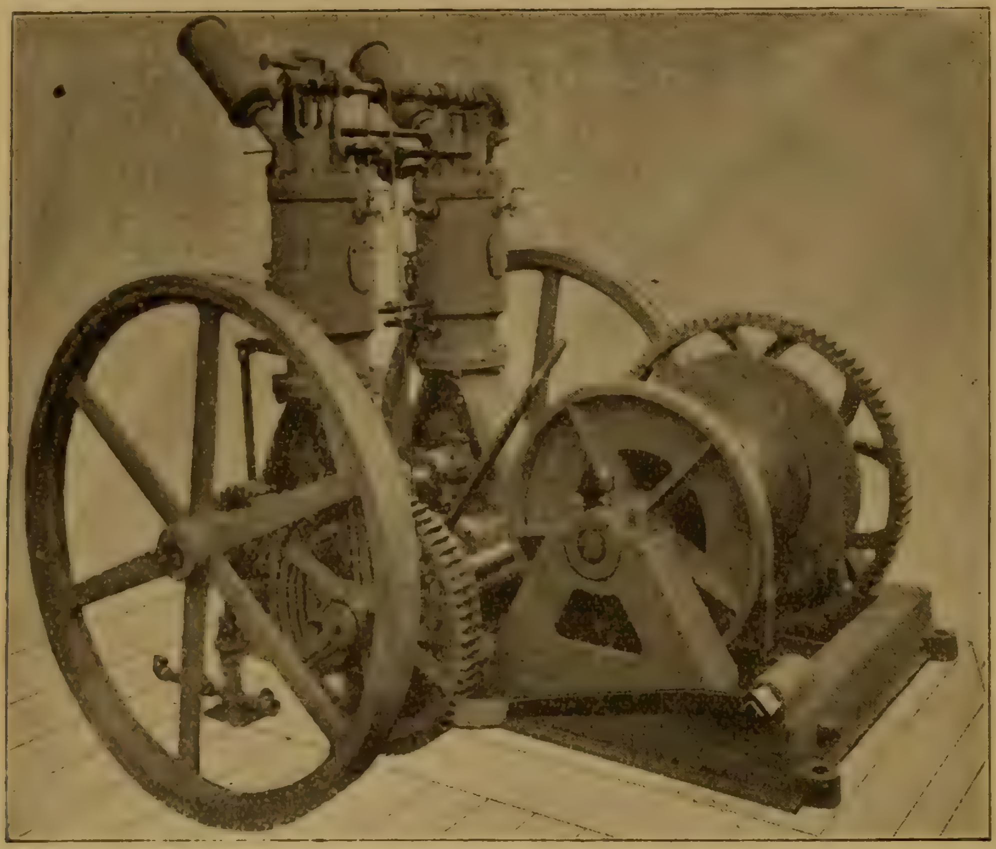
JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.



The "Golden Gate" Gas Engine

is not a new comer, but has not been advertised in the papers as some others, but if you are in need of a Gas Engine, just ask anyone who ever had anything to do with them, and they will tell you:

"Get the Golden Gate."

Uses Gas or Gasoline.

Made and Sold by

ADAM SCHILLING & SONS

211-213 Main Street, San Francisco.

The "GOLDEN GATE" is made strictly according to its own Letters Patent issued.

FRANCIS SMITH & CO.

130 BEALE STREET, SAN FRANCISCO

☞ Iron cut, punched and formed, for making pipe on ground where required. All kinds of Tools for making Pipe. Estimates given when required. Are prepared for coating all sizes of pipes with a composition of asphaltum.

SMITH & YOUNG

BUILDING SUPPLIES

230½ South Spring St., Los Angeles, Cal. — **723 Market St., S. F., Cal.**

Specialities.—Blue Print Paper; Casing Blocks; Deadening Felt; Infusorial Earth; Lamps, Buckeye Incandescent; Bostwick Steel Lathe; Marble; Mineral Wood; Mouldings, Turned Art; Paints, Plumbago and Malthine; Pecora Mortar Stains; Roofing; Sheathing Papers; Sash Balance and Lock, Combined; Shingle Stains; Soapstone; Spiral Balusters; Wood Carvings and Ornaments.

LEPPIEN COLLECTION AGENCY

LAW COLLECTIONS

Room 1. **110 SUTTER STREET.**

SAN FRANCISCO

CENTRIFUGAL PUMPS

Construction, Operation, History and Examples.

BY JOHN RICHARDS.

TWENTY-THREE ILLUSTRTAIONS.

In Cloth Binding, postpaid.......... $1.00

INDUSTRIAL PUBLISHING CO.

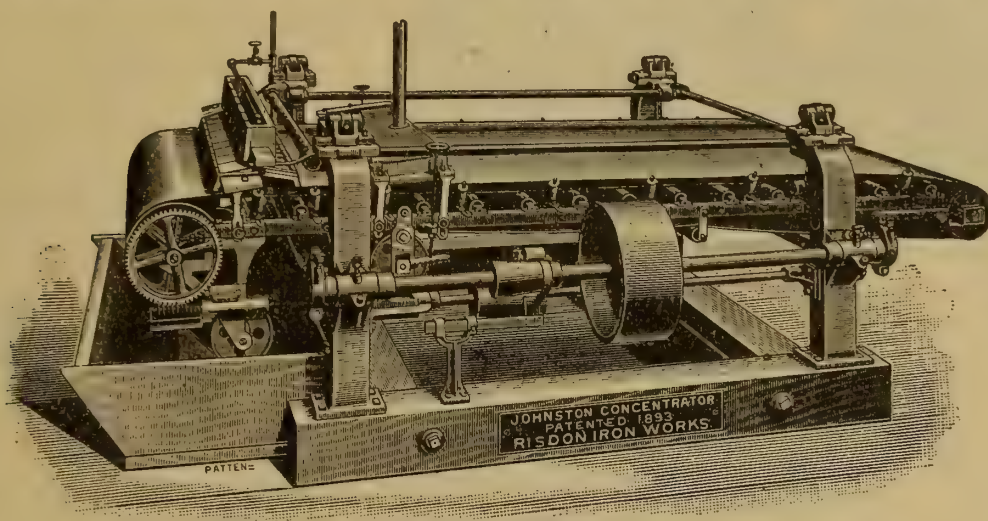
40 California St., San Francisco.

Risdon Iron Works

Cable Address: "RISDONS."

BEALE and HOWARD STS., SAN FRANCISCO.

JOHNSTON CONCENTRATORS



Simplicity of Construction **Great Durability** **Ease of Operation**
Increased Percentage of Sulphurets Saved

AWARDED FIRST PRIZE AT MIDWINTER FAIR, FOR CONCENTRATORS, PUMPS, BOILERS, AND BALL ENGINES

WHAT USERS OF THE JOHNSTON CONCENTRATORS SAY:

THE HUDSON GOLD MINING CO., WARD, COLORADO, June 8th, 1894.

THE RISDON IRON WORKS,
SAN FRANCISCO.

GENTLEMEN:—After a thorough test of the Johnston Concentrator, I am so well satisfied, that I wired you to ship me two more, as speedily as possible. I find the machine well constructed, easily kept in order, requiring but little attention, and doing entirely satisfactory work on our ore. After my experience with other tables, I am congratulating myself on my possession of the Johnston.

Yours faithfully, B. LANGRIDGE, Ph.D., Mining Engineer.

SAN FRANCISCO, CAL., June 1st, 1894.

THE RISDON IRON WORKS,
SAN FRANCISCO.

GENTLEMEN:—We have tested the Johnston Concentrator furnished us by you on trial, and, after an exhaustive trial, we are satisfied it is the best in the market. Please prepare and ship us, as soon as possible, thirteen more machines.

Yours truly, APOLLO CONS MINING CO.
By LEON SLOSS.

WE ARE AGENTS FOR

- Heine Boilers.
- Ball Automatic Engines, for Pacific Coast.
- Improved Wheelock Engine, With Hill Valve Gear.
- Conover Condensers.
- Webster's Vacuum Heaters and Purifiers
- Baragwanath Feed-Water Heaters.
- Davidson and Marsh Steam Pumps.
- Smith-Vaile Duplex Pumps.
- Centrifugal and Triplex Pumps.
- Phillips' Metallic Packing.
- Matheson Lock-Joint Pipe.
- Hydrants, Gate Valves,
- Pressure Reducers, etc.

SEND FOR CIRCULARS AND PRICES.

"INDUSTRY."

JOHN RICHARDS, EDITOR.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

SAN FRANCISCO.

FOUNDED 1888. MARCH, 1895. NO. 80

Constructive Engineering on the Pacific Coast.

NO. IV.

SHIP BUILDING.

The achievements of countries and people should be compared by two standards, one of degree, and one of opportunity, and in treating upon ship building on the Pacific Coast, opportunities and environment should be taken into account, not in excusing a lack of degree, for that needs no excuse, but as a measure of the skill and energy that has entered into this important industry.

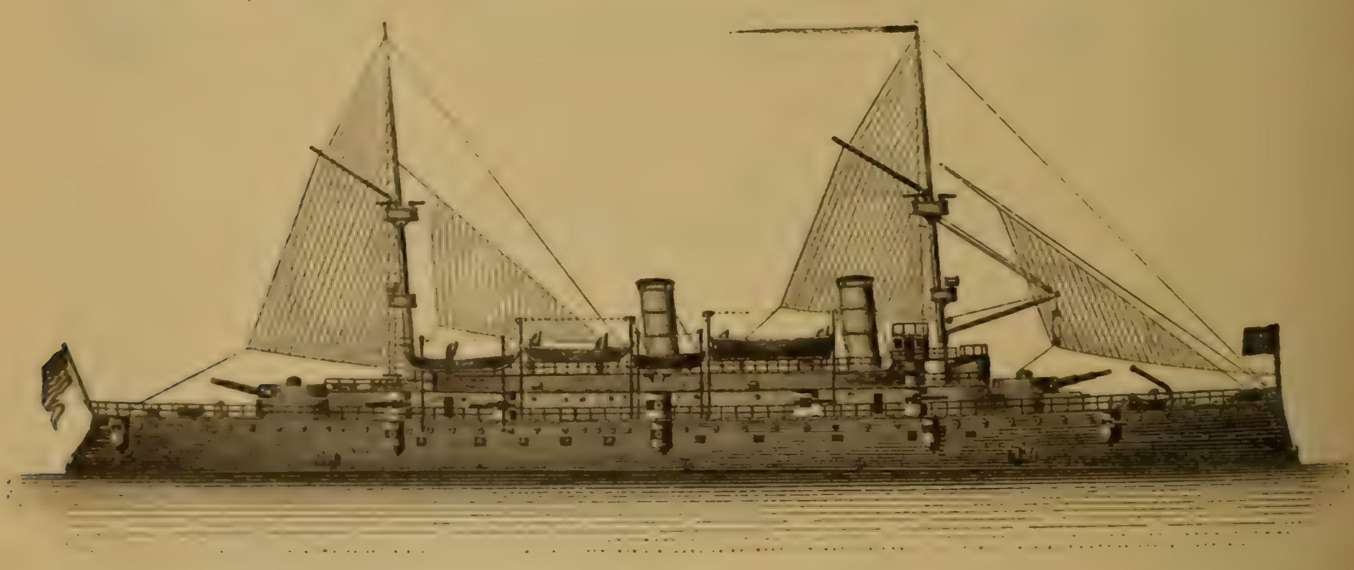
The first triple expansion marine engines made in the United States, were fitted into the *Balaena* here in 1882, and the first steel ship, the *Arago*, was built by the Union Iron Works, in 1886. Since then, yards of this company at the Potrero, on the south side of San Francisco, have been nearly all the time filled with either merchant or war vessels.

The hydraulic dock, as we believe the only one of the kind on this continent, is a most creditable feature of the works, designed and built by the company. It is an immense pontoon or platform, raised by hydraulic pistons, seventeen on each side, with synchronous action.

The principal war vessels built at these works, are the cruiser *Charleston*, Coast defense vessel *Monterey*, cruiser *San Francisco*, cruiser *Olympia*, and battle-ship *Oregon.*

Of these vessels, the *San Francisco* and *Olympia*, are as we believe, the best made and most complete in the United States Navy. We had occasion some time ago, after spending half a day in going over the latter ship, to speak of the fitting and finish, even down to the surfaces of the painted plate work, then and now claimed to have no parallel among many vessels gone over in this and other countries. The *Olympia* has just gone into commission, and fine photoplates have been sent to show her when complete, but too late to be engraved.

The drawing herewith and the particulars that follow, will give a good idea of the vessel.



THE "OLYMPIA."

"The *Olympia* would be rated as a cruiser of the first class, having both the tonnage and the speed to give her that rating.

Her battery consists of the following: Four 8-inch B. L. R. guns mounted in two turrets; ten 5-inch R. F. guns, these are sponson mounts in the superstructure; fourteen 6-pound R. F. guns, mounted in sponsons on the berth deck; six 1-pound R. F. guns, and four Gatling guns. Her principal armor consists of a protective deck 4¾ inches thick, slope, and 2 inches thick, crown. The 5-inch battery is protected by 4-inch armored sponsons. The barbettes and turrets are protected by 4-inch harveyized armor. All the six-pounders are protected by 2-inch sponson armor.

Length, 340 feet; beam, 53 feet; draught of water, normal trim, 21 feet, 6 inches; displacement, 5,840 tons; indicated horse power of vessel on trial, 17,313.

There are four double-ended boilers, with four furnaces in each end, 15 feet 4 inches diameter, 21 feet long. Two single-ended boilers with four furnaces each, 15 feet 4 inches diameter, and 11 feet long.

Radius of action at 10 knots speed, 6,500 knots. Radius of action at 20 knots speed, 2,500 knots.

The contract for the *Olympia* was executed on the 10th day of July, 1890. She was completed in December, 1893; but on account of the delay in obtaining the harveyized armor for the turrets, she was not delivered to the Government until the 26th of January, 1895.

The contract price of the *Olympia* was $1,796,000. Besides that the Government paid a premium for extra speed obtained of $300,000. Extensive changes were made during the construction of this vessel, which changes involved a further cost of $250,000, so that the vessel has cost the Government about $2,350,000. She is undoubtedly today the finest vessel of her class afloat.

The battle-ship *Oregon*, of 10,600 tons, now far advanced, will be the next to add to the Pacific Coast list.

In merchant shipping there is a long and creditable list of production on this Coast, and in some respects peculiar. The tug boats for example are built most of them for heavy open sea service, and capable of going to any port along the Coast."

THE "FEARLESS."

The latest addition to this fleet, the *Fearless*, was built at the Union Iron Works in 1891.

The company furnish the following particulars of this vessel:

"The *Fearless* was built in 1891. She was intended to be, and we believe still is, the strongest and most powerful tow boat afloat. She is built entirely of steel, the scantlings of both frames and plating being unusually heavy. The deck, and all wood trimmings, are of East Indian teak. The deck houses are of steel, and very handsomely fitted up. The dimensions are as follows: Length over all, 152 feet, 6 inches; length on load water line, 145 feet; beam, 26 feet; depth for tonnage, 16 feet; displacement in sea going trim, 675 tons.

She is fitted with triple expansion engines, with independent air and circulating pumps. Dimensions of engines are: high pressure cylinder, 20 inches; intermediate, 30 inches; low pressure cylinder, 50 inches; stroke 36 inches. These engines are supplied with steam from two boilers, 11 feet diameter, 13 feet long, each having two furnaces, 42 inches diameter. Heating surface in each boiler is 1,460 square feet; grate surface, 42 square feet; indicated horse power 1,100.

The vessel is fitted with a very powerful pumping plant for fire purposes. She has a large fire hydrant forward, capable of taking the whole water from the pumping engines. The nozzle for this is fitted on a trunnion, and is operated like a hydraulic nozzle, and can throw a 2½-inch stream."

The *Fearless* has made a notable record in towing vessels on this Coast, and also a notable record in her ability to cover great distances, having at one time steamed between 6,000 and 7,000 miles without re-coaling. Both the owners and builders of this vessel have good reason to feel the pride that they do in her, and in the work she has accomplished.

FERRY BOATS.

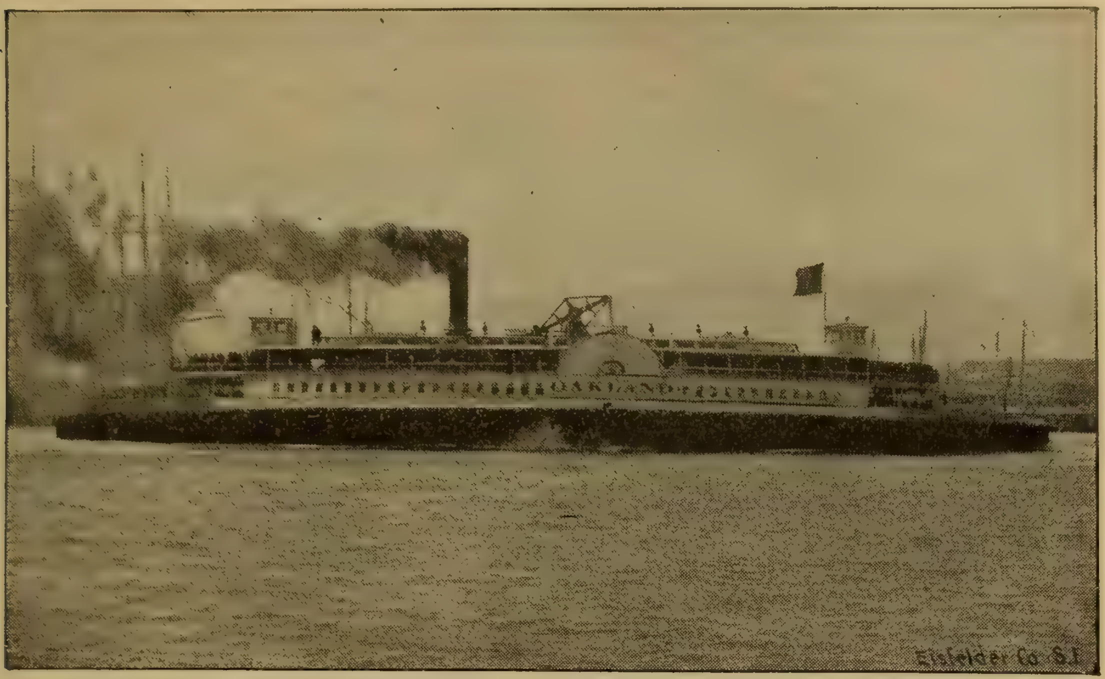
The ferry service on the Bay of San Francisco, represents many special features of constructive engineering that have been developed here.

San Francisco is almost an insular City, It is situated on a narrow peninsula, faces the water, and about four fifths of its traffic is across the water, distances of three to six miles.

This calls for a great fleet of ferry steamers of large size and unusual speed. They are for the most part of conservative build, fitted with single beam engines, but capable of service in heavy weather and rough water.

The Bay extends on the south about 40 miles, and as this is the direction from which come the principal storms, there are seas as

heavy as the depth of the water permits, and often dangerous for low decked vessels.



FERRY BOAT "OAKLAND."

The *Oakland*, shown above, is typical of the San Francisco ferry boats. She is 280 feet long over all; 40 feet beam; and 1,100 tons register; has a beam engine of 1,160 horse power, 60 inches diameter, 12 feet stroke. There are two boilers 28½ feet long, 9 feet diameter, each having ten flues, from 9½ to 14 inches diameter, and 102 direct tubes of 4½ inches diameter, and 228 return tubes 3½ and 4 inches diameter, making up 6,930 square feet of heating surface.

This vessel was built by the Central Pacific Railway Company at their yards in Oakland, and, as before said, is selected as typical of the ferry system at San Francisco.

These particulars are furnished by Mr. H. J. Small, Superintendent of motive power for the Southern Pacific Company, who at the same time sends dimensions of the *Solano*, a special ferry boat of that company for conveying trains across the Straits of Carquinez, thirty miles east of this City.

Every traveler to San Francisco by the Central Pacific route will remember how the journey was broken at Benicia, and the ferry there mistakenly taken as the end of the land journey. This, in fact, might have been true, as at one time the metropolis came near being fixed at Benicia, instead of on the sand dunes of this peninsula.

TRANSIT BOAT "SOLANO."

This vessel, built in Oakland, Cal., is no doubt the largest ferry boat in use at this time.

The *Solano* is 3,541 tons register, 424 feet long, and 116 feet wide over her deck, the hull being 64 feet. She is driven by beam engines, one at each side, 60 inches bore, 11 feet stroke, of 4,000 horse power. Her boilers, eight in number, have 19,640 square feet of heating surface. There are four sets of rails on her deck to receive trains, capable of conveying an engine and 48 freight cars, or 24 passenger cars of the largest class.

Down to ten years ago the engines for the ferry service here were made in the East, but since then the new boats added have been wholly constructed here, the latest additions being the *Piedmont*, *Tiburon*, *Ukiah* and *Sausalito*. The first-named boat, of the same tonnage and power as the *Oakland*, has inclined puppet-valve engines beneath the main deck, and a number of novel features besides. The machinery was constructed at the Central Pacific Railway shops in Sacramento.

Perhaps the best evidence of completeness in this Bay ferry service is to say that in fifteen years of the writer's knowledge not a single life has been lost on these boats by fault of construction or navigation, which is the more remarkable considering the crowded traffic the boats are driven through, the prevalence of dense sea fog, winter storms, and the speed, which is on the longer runs from 13 to 16 miles an hour.

CALIFORNIA COMBINED HARVESTING MACHINE.

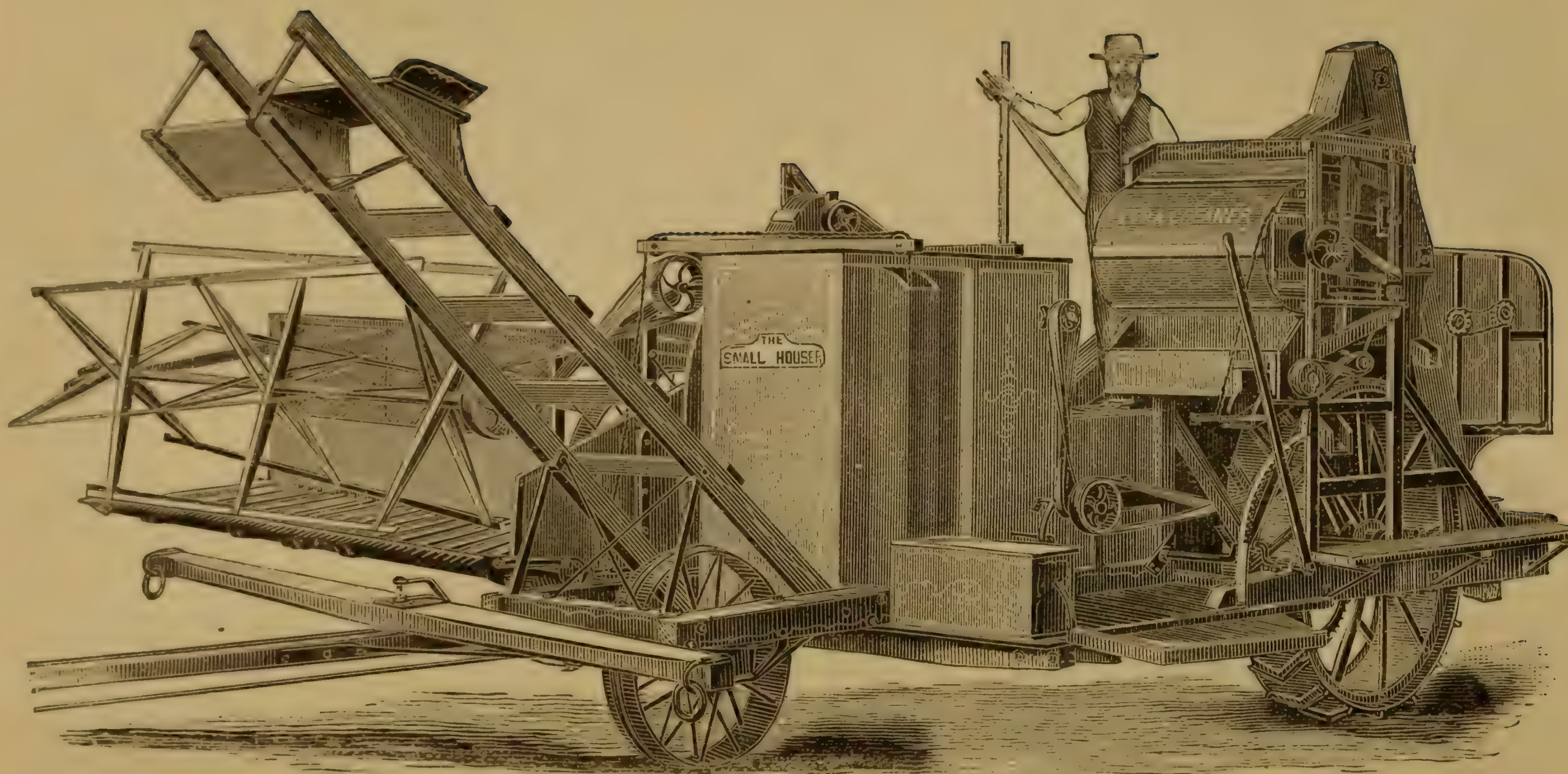
THE STOCKTON COMBINED HARVESTER AND AGRICULTURAL WORKS, STOCKTON, CAL.

Some years ago it was claimed in "INDUSTRY" that wheat was cut and threshed cheaper in California than the same work could be done by the ryots of India. This claim was made on some calculations made at the time, and was perfectly correct. The statement seems extraordinary, but is plain enough when the facts are considered. The climate is a main factor in the case, the long rainless summers permit the wheat to stand without injury after it is matured until the farmers are ready to harvest it. Then the sacks can be piled up in the fields, and remain there until he is ready to haul them away.

The wheat is never cut until perfectly dry, at least cannot be cut in the most expeditious manner by combined machines until dry, because "harvesting" includes cutting, threshing and winnowing the wheat at one operation by a single machine called a "combined harvester." These machines, one of which is shown in perspective on the next page, were invented here in California, and are a notable example of bold machine scheming that would never have been undertaken by anyone who had computed the chances of success.

We can well remember when, fifteen years ago, we first saw a drawing of one of these machines, and in a few minutes decided that it was a visionary and impracticable scheme, because in such an aggregation of parts, where the integrity of the whole depended on each separate element or member, for cutting, threshing and cleaning, the machine could not be kept in operation, jolting over the ground, going up and down grades. Besides, the motion derived from animal traction would never do to operate the threshing and cleaning elements that had to be driven at or nearly uniform speed.

We will not call this a scientific forecast, but it had foundation in a long experience in constructing machinery of various kinds, and by the application of familiar rules thought to be without exceptions. It was a mistake. The machines were made and operated like the rotary engine of Mr. Dudgeon, of New York, advertised twenty-five years ago, "they go, and continue to go," and now are almost exclusively employed in harvesting the valley wheat crops in California as far as the dry seasons extend.



COMBINED HARVESTING MACHINE.

STOCKTON COMBINED HARVESTER AND AGRICULTURAL WORKS, STOCKTON, CALIF.

The machines have passed through the usual course of evolution, each year with some addition or change to reduce cost or secure endurance, but remain in essential features much the same as the one that called out our mistaken prophecy. They are arranged to cut from ten to twenty feet wide, requiring for propulsion a little more than one horse for each foot of width. Twenty to thirty acres are cut in a day with three to four men as attendents, including the driver, who is perched up on the ladder frame seen in front. The capacity of the machines in wheat cleaned depends of course on the yield. All that stands on the ground goes through them. 400 to 500 bags, or 1,200 bushels, is an average on valley lands.

The company at Stockton in answer to an inquiry respecting the capacity of the machines sends a number of letters from those who have combined harvesters in use, and the following extracts from those letters will afford all required data of the cost of harvesting wheat in California.

"I cut 1,200 acres with the 16-foot Houser belt machine, averaging about 30 acres a day in heavy wheat, and threshed about 400 sacks a day without any expenses for repairs. I run 4 men and 22 horses." * * * * * *

"I cut and threshed 1,000 acres of grain in about 40 days with the 14-foot combined harvester I bought of you last year. 300 acres of wheat yielded 4,781 sacks,† and was badly tangled, in fact part of it flat on the ground." * * * * *

"I started in grain that yielded 40 bushels per acre; had no difficuity whatever, and threshed from 400 to 500 sacks per day, separating the grain from the straw perfectly, and cleaning it as well as any machine in use." * * * * *

"We cut 2,470 acres in 57 days, making 35,550 bushels, with less waste and about the same expense that it would take to put it in the stack, making a net saving of $2,488.50 for threshing. The machine did its work well. Had no difficulty in cutting a full 20-foot cut in down grain and green weeds with four men." * *

"I bought one of your combined harvesters last season, and harvested 1,250 acres in 40 days. It cost me less to corral my wheat already sacked at the house (excepting the cost of sacks) than it would to have headed and stacked the same grain in the field unthreshed." * * * * * *

"The 16-foot Houser harvester I purchased of you cut and threshed 1,300 acres of grain in 47½ days with 22 animals. I had no trouble in light or heavy grain, and it cut and cleaned barley as well as wheat." * * * * *

† A "sack" in California contains 140 pounds, or 2⅓ bushels.

"We harvested about 1,800 acres in 45 days with the two 14-foot cut Houser harvesters purchased of you this past season at an expense of 60 cents per acre for labor hire for four men for each machine." * * * * * *

The wages paid to attendants average $8.00 per day for four men, and the use of sixteen horses can be estimated at $8.00 per day; wear, tear and interest at $4.00 per day, making up $20.00. This divided by 30, an average acreage for one day, will give 66⅔ cents per acre, and if the yield is twenty bushels per acre, the cost per bushel for cutting, threshing, cleaning, and sacking, will be 3⅓ cents, which will seem incredible to farmers in the Eastern States.

California people justly have a good deal of pride in this combined harvester matter, and it is on every ground a remarkable example of special constructive skill. There is in one of these machines, constructed without precedent, the result of more anxiety, worry, special skill, risk, and obstinate battle with failures, than in any steamship ever constructed. There is not a wheel, shaft, band, brace, or other element, that can be computed from rules, all is experiment and observation. It is estimated that the number of machines of this kind now in use exceeds 1,500, and the period of experiment is left far behind.

The next thing required, and it has received a good deal of attention, is some kind of motive power to supplant the horses for propulsion. The dust and heat causes great loss in this way in certain sections of the country lying inland from the coast too far to be influenced by the ocean. Experience and increasing care has, however, done much to save the horses employed to drive the machines.

THE LOGIC OF REFORM.

There is no good citizen who does not feel an interest in the present "ebullition" against legislative and executive roguery, but not one in twenty considers the fundamental causes that lie at the bottom of the evils combatted. We have universal suffrage, and a representative system of government, called sometimes; the "foundation of liberty," and then cry out against that very liberty which the system invites and insures.

Under this method the vote of an ignorant and vicious man is just as good as the vote of the educated and upright citizen; also the assumption that one is as much entitled to representation as

the other; then on what ground of right or fairness can we expect pure government, except in an absolutely pure community? If there are three thousand bar rooms in San Francisco, and thirty thousand patrons of these places, why should not this element be represented, in proportion to the votes furnished by the drinking interest? If the sporting element, as it is called, is extensive, which no one can deny, why should they not be represented among the Police Commissioners?

It is a burlesque on the ignorant and criminal element in community, to give them equal rights as citizens, of voting and to representation, and then deny them a place in the legislative, executive, and judical conduct of public affairs. It is illogical, and is impossible to do otherwise under the great system of "liberty," when one man is as good as another, and as the Hibernian motto adds, "a little better."

If a person dares to assert that good government must come from and by good people, and that the functions of government, or at least those of administration, should not be exposed to the chicanery of voting, or participated in by the unworthy, such a person is set down as a monarchist or worse, but the time may come when opinions will be different.

Aside from the evil of representation by the ignorant and criminal elements of community, there is the farther one of a want of responsibility. This is the incentive and key to faithful and honest service, and the present evils in American municipal government are due in a great measure to the fact that no one is responsible.

Take for illustration the smallest example, that of a municipal corporation of the sixth class, under the laws of this State. There are elected a board of five trustees, who have certain legislative functions and administrative powers, the latter exercised through a clerk, a treasurer and marshal, but these officers are also elected, and are responsible to the people, not the trustees. The board also appoints a recorder, but he must be an elected justice of the peace. It appoints a town surveyor or engineer, who like other officers must be a resident and elector, so that when complete the responsibility rests in no definable place. In theory it goes back to the electors, and these need only to have resided thirty days in the precinct to vote, they may have no interest in the town, no residence there, still exercise the same rights as the property owner and permanent citizen.

Out of this comes what?

The influence and policy of the most active, those seeking the crumbs of public favor and the license of inimical pursuits.

Suppose that an organized industry, a railway or any business enterprise, were to be managed in the same manner, and the stockholder with one share had the same elective authority as the one with a thousand shares, and that the administrative officers were independently elected, and no centralized responsible authority. It is not supposable at all, no such a business would last a year.

What applies to a small organization under this "free and equal" system, still more applies to the greater organizations of country, State and Nation.

These spasmodic reforms, such as are now going on, are the most effective means of calling attention to the fundamental causes, but the search for such causes have not reached farther back than the control of the irresponsible voter by the astute politicians and business men, who find in this scheme of unqualified suffrage and irresponsible officers, an opportunity of purchasing privileges to their own advantage.

Under the *Ægis* of liberty has thus grown up tyranny, and a corruption that can have no end, until the laws are made and enforced by the best and responsible part of community.

There is no logic or reason for popular suffrage extending beyond the legislative elements of any government. The executive branches are but the performance of law, by officers supposed to be guided by honest discretion. The selection should be a question of character and capacity, not one of policy. So that in the administrative branches, reform need not be looked for so long as such officers must represent all classes of community, the bad as well as the good, the responsible and the irresponsible alike.

In a new charter now being prepared for San Francisco, if State meddling is cut out, and the appointing power centralized in some responsible source, there will be reform, not otherwise. The whole problem is plain when viewed by anyone divested of personal interests and prejudice, and if it could be mathematically, which means truthfully dealt with, there would soon be change.

To illustrate this, there are in San Francisco perhaps one engineer and one medical doctor to ten politicians and public officials. There is not a change, discovery, or the least discovery made in the applied sciences, mechanic arts, surgery or therapeutics, in any part of the civilized world, that does not find its way here

as fast as the mails can carry the fact, if important it may even be telegraphed, and is considered, compared, and adopted at once if good. It is an organization of the world for progress in these arts.

In contrast how is it with municipal government? Is there any seeking after and applying knowledge? Is the method of collecting, disbursing and applying revenue in the various cities of the world studied or even heard of? There is not perhaps among the Supervisors of this City, one who has studied the municipal conduct of a place so familiar as Glasgow. They do not want to know these things. It is not relevant to the purpose for which they were selected and the things they are to promote.

For thirty years past, there has not been a superintendent of streets in this City, who understood anything of street making or the many technical matters connected therewith, and on the free and equal system should not have been, because the number of people who do understand such things and would vote for a qualified man to fill this office, are too few in number to claim representation.

The nature of the duties and the qualification of candidates, is not much considered in a system that selects officers by counting the votes of men who clean the sewers and streets.

THE HOWDEN SYSTEM ON THE PACIFIC COAST.

Being aware that the Union Iron Works had recently fitted the steamship *Pomona* with the Howden system of furnaces, we applied to Mr. G. W. Dickie, the manager, for information as to results. He sends the facts and statistics presented herewith, which must be a matter of the greatest interest to steamship owners generally, and especially in the case of vessels running out of California ports.

We may also explain that the Howden system consists in the use of heated air, in part, a forced blast, and other features which will be explained at more length next month. The system is now so spreading that Mr. James Howden, of Glasgow, the inventor, has been compelled to give the manufacture of his apparatus over to others, and now prepares only plans for fitting vessels. His orders in January exceeded one ship each day.

Mr, Dickie's communication is as follows:

"Referring to your letter of the 2nd inst. asking for publication of the principal facts in the results obtained by fitting the steamship *Pomona* with the Howden system of combustion.

About one year ago the Union Iron Works opened negotiations with James Howden for the purpose of securing the exclusive right to build for the Pacific Coast his special arrangements of forced draught and combustion, now known as the Howden system.

Having secured the necessary rights from Mr. Howden, the Union Iron Works sought for an opportunity to install this system on some vessel engaged in the coast trade. Arrangements were finally made with the Pacific Coast Steamship Company to apply the system on their steamship *Pomona.*

The reasons for selecting the *Pomona* were two fold. First, the *Pomona* was already a very successful vessel, and the most economical in their fleet, both as to consumption of fuel and general efficiency. It was therefore considered that if the Howden system could show an advantage on the *Pomona*, it would be due entirely to the inherent merits in the principle of combustion employed by Howden. Second, the vessel was engaged on a regular route, and her performances after being changed could be very readily compared with her performance previous to the change.

In order to have a basis for comparison before the vessel was fitted to receive the Howden system, a very careful test was made to determine her economical qualities, and also to prepare data for comparison. It was decided during one of her trips to make a careful test of six hour's duration. This was done under the direction of the company's engineer, and the engineer of the Union Iron Works.

After the vessel was fitted with the Howden system it became necessary to change her from the Eureka route to the San Diego route. Voyage comparison could therefore not be so readily made as if she had remained on the route that she had been so long engaged in.

Previous to the change the boilers of the *Pomona* had a heating surface of 2,963 square feet, and a grate area of 102 square feet. With that boiler capacity the best that could be done for collective horse power was 1,078, that being the power obtained on the six hours' test, and it was acknowledged that this amount of power could not be maintained with Franklin coal throughout the 24 hours, as the fires were not in as good condition at the close of the six hours' trials as at the beginning of it.

In fitting the Howden system the grate area was reduced from 102 square feet to 80 square feet, the heating surface remaining the same. Not having had any experience with this system in connection with Pacific Coast coals, it was thought advisable not to attempt to obtain the horse power per foot of grate that Howden claimed was possible.

On her first trip, however, the *Pomona* showed that a still further reduction of grate surface would be an advantage, even if the horse power was to be maintained at a considerable increase over what was possible before. The grate surface was therefore reduced to 73 square feet, which is the grate surface now employed on the vessel.

The following table shows the economical condition before and after being fitted with the Howden system :

S. S. "POMONA." RESULT OF MACHINERY TRIALS BEFORE AND AFTER FITTING WITH HOWDEN'S FORCED DRAUGHT SYSTEM.		VOYAGES. San Francisco to Eureka. Aug. 29, 1894. Without Forced Draught	VOYAGES. San Francisco to Port Harford Nov. 29, 1894. With Forced Draught
Duration of Trial		6 hours.	16 hours.
Average Pressures	Engine Room Steam	145.4	147.8
	First Receiver	41	42
	Second Receiver	5.59	6.15
	Vacuum	25.4	24.8
Revolutions per Minute		91.22	99
Mean Pressure in Cylinder	H. P.	51.1	62
	I. P.	21.23	25.8
	L. P.	8.71	10.8
M. P. Reduced to L. P. Cylinder		25.06	31.5
Average Indicated Horse Power	Main Engines	1020	1388
	Auxiliaries	58	84
	Total	1078	1472
Air Pressure in Inches of Water		.29	.77
Coal Burned	Total on Trial	14415	49410
	Per Hour	2402.5	3088
	Per I. H. P. per hour	2.22	2.09
	Equivalent in Cardiff Coal		1.4
	Per sq. ft. of Grate Surface per hour	23.5	42.3
Heating Surface per I. H. P		2.74 sq. ft.	2.00
I. H. P. per sq. ft. of Grate Area		10.56	20.16
Grate Surface in Use		102 sq. ft.	73 sq. ft.
Class of Coal		Franklin, Good Quality.	Franklin, Bad Quality.
Draught of Vessel	Forward	7 ft. 11 in.	10 ft. 8 in.
	Aft	12 ft. 6 in.	13 ft. 6 in.
	Mean	10 ft. 2½ in.	12 ft. 1 in.
Displacement of Vess 1		1150 tons.	1455 tons.

NOTES.

Diameter of cylinders, first trial, 23, 34, 56 × 36 inches. Diameter of cylinders, second trial, $23\frac{5}{16}$, $34\frac{3}{16}$, 56 × 36 inches. Heating surface for two boilers, 2,963 sq. ft. Total grate area, first trial, 102 sq. ft. Total grate area, second trial, 73 sq. ft.

Comparative evaporative value of Cardiff and best Franklin coal, as tested at the Union Iron Works, under forced draught, when Franklin = 1.00, Cardiff = 1.5. Cardiff coal = 11.339 pounds of dry steam from 212 degrees. Franklin coal = 7.575 pounds of dry steam from 212 degrees. Coal on forced draught trial of very much inferior quality to that used on natural draught trial. Coal on forced draught trial making great waste in ash and large clinker.

REMARKS.

First Trial.—Strong head wind. Moderate sea. Throttle full open. Horse power cut-off 19½. Air and circulating pumps, 62 revolutions estimated at 48 I. H. P. with 30 pounds preferred M. P. Sanitary Pump estimated at 10 I. H. P.

Second Trial.—Air and circulating pump estimated at 56 I. H. P. Sanitary pump 10 I. H. P. Electric engine 13 I. H. P. Blower 5 I. H. P. Total auxiliaries 84 I. H. P. Average temperature of engine room, 100 degrees.

It will be noticed that notwithstanding such a large reduction in the grate surface, from 102 to 73 square feet, the power can be readily maintained at 1,472 horse power, while previous to the change the best that could be done with 100 square feet of grate surface was 1,078 horse power.

It will also be noticed that the very large increase of power is obtained with a very marked increase of economy, the coal per horse power before conversion being 2.22, and after conversion 2.09. It may also be stated that this economy has not only been maintained since the tests have been made, but has really been increased, taking the whole voyage for comparison.

It will also be noticed that while the first trial before conversion was for six hours, the test after conversion was for sixteen hours, showing that the conditions obtained on the test after the Howden system was fitted were conditions that could be continuously maintained. The quality of Franklin coal has also deteriorated very materially between the time the first trial was made and the trials of the Howden system.

The results of the fitting of the *Pomona* with this system proves the subject to be of very great importance to the Pacific Coast, as it enables inferior coals to be burned, and to obtain from them all the heating power that they contain.

We would call attention also to the fact that the results obtained with Franklin coal compared with Cardiff coal shows that this vessel can continuously produce one horse power per hour per 1.04 pounds of coal, which compares very favorably with the best results obtained in Europe. We expect that the application of this system

will open up a wider field of use for the poor coals of the Pacific Coast.

The steamship *Columbia*, of the O. R. & N. Co. is to be fitted in the Spring, with new boilers and the Howden system, and there is no doubt that many others will have to follow the same example.

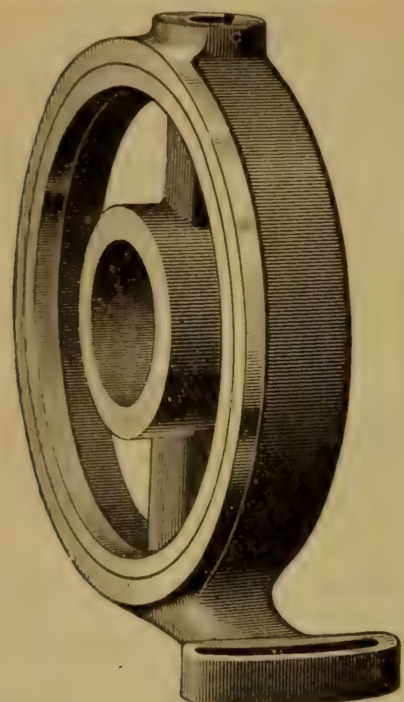
AN IMPORTANT INVENTION.

The preservation of green fruit by dry packing, especially table grapes, seems to be a subject that has met with a good deal of neglect in this country, especially on this Coast, where one would naturally expect research and complete knowledge in the matter.

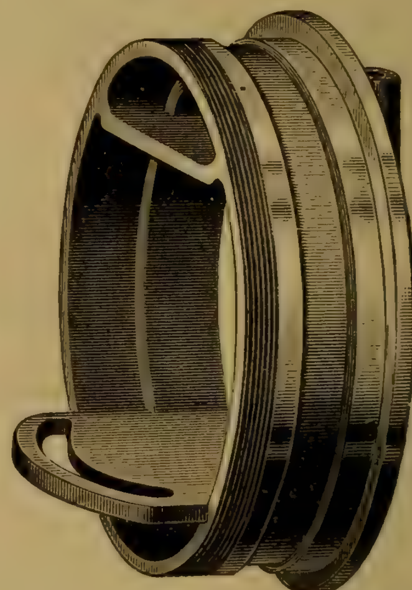
It seems that fruit with a tough skin or covering, if protected from crushing, puncture and the circulation of air, can be preserved fresh for many months if kept cool and dry. The grapes from the Kelly Islands, for example, are often seen at Christmas time, kept in a packing of plain sawdust. Foreign grapes come here in a fresh state packed in cork dust or shavings, which form an ideal material for that purpose, because of being soft, impervious to moisture, and, above all, having no odor that would be imparted to the fruit.

Mr. A. D. Shepard, of this City, has been for a year and a half past experimenting with material for this purpose. Cork dust or shavings are not obtainable in quantities, or at a price here that permits use as a packing material, and Mr. Shepard set out to find a substitute, cheap in price, and having the same qualities.

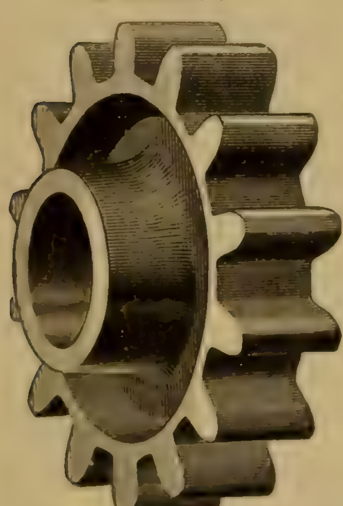
The result is what may be called "sterilized" wood sawdust, which by certain processes of treatment is rendered soft, inodorous and resistant to moisture. The sawdust, which can be from any kind of wood, but preferably from spruce or fir of any kind, is placed in a close retort, and saturated with hot water or moist steam until all resinous or other soluble matter is washed out. This is followed by dryer and hotter steam, and finally by hot air, so the mass is thoroughly triturated, washed, dried, and, in a degree, charred, the latter giving the property of resisting moisture. The material can be prepared, put in bags, and furnished at a low price compared to cork cuttings, and the invention, which has been patented, is likely to be one of much importance in fruit preserving.



Diameter......................10½ inches.
Bore .... 8½ x ¾ inches.
Bore of Hub.................. 3 inches.
Chambered......... 9½ x ½ inches.
Faced both ends, finished in 30 minutes.



Diameter.........................9⅛ inches.
Length............................2½ inches.
Finished in 30 minutes.



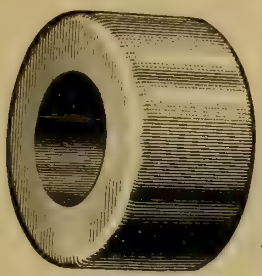
Diameter......... .... 8 inches.
Length...................... 2¾ inches
Bore...................... 2 1-16 inches.
Both sides ,faced, web and hub turned. Finished in 8 minutes.

Diameter.................. 7½ inches.
Length..................... 3¼ inches.
Bore..................... 2 1-16 inches.
Faced both ends, web and hub finished. Finished in 12 minutes.

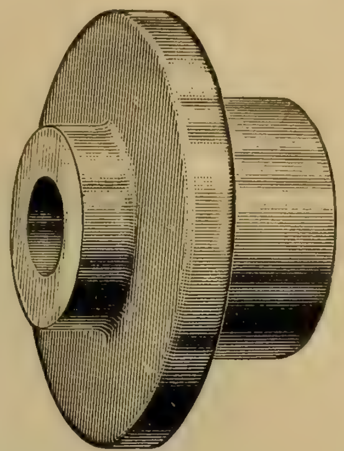
Large Diameter .... 5 inches.
Length....................... 7½ inches.
Bore .... 2 7-16 inches.
Finished all over in 22 min.

Diameter ....2 1-16 inches.
Length.................. 3¾ inches.
Bore.................. 1 3-16 inches.
Finished in 8 minutes.

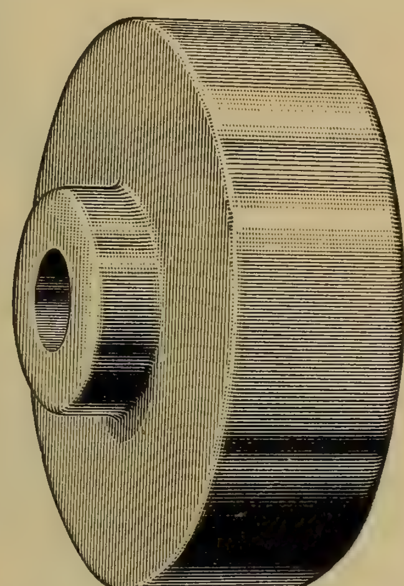
EXAMPLES OF WORK DONE ON A TURRET LATHE.



Diameter.................. 3½ inches.
Length.... .... 1⅞ inches.
Bore..................... 2 3-16 inches.
Finished all over in six minutes.



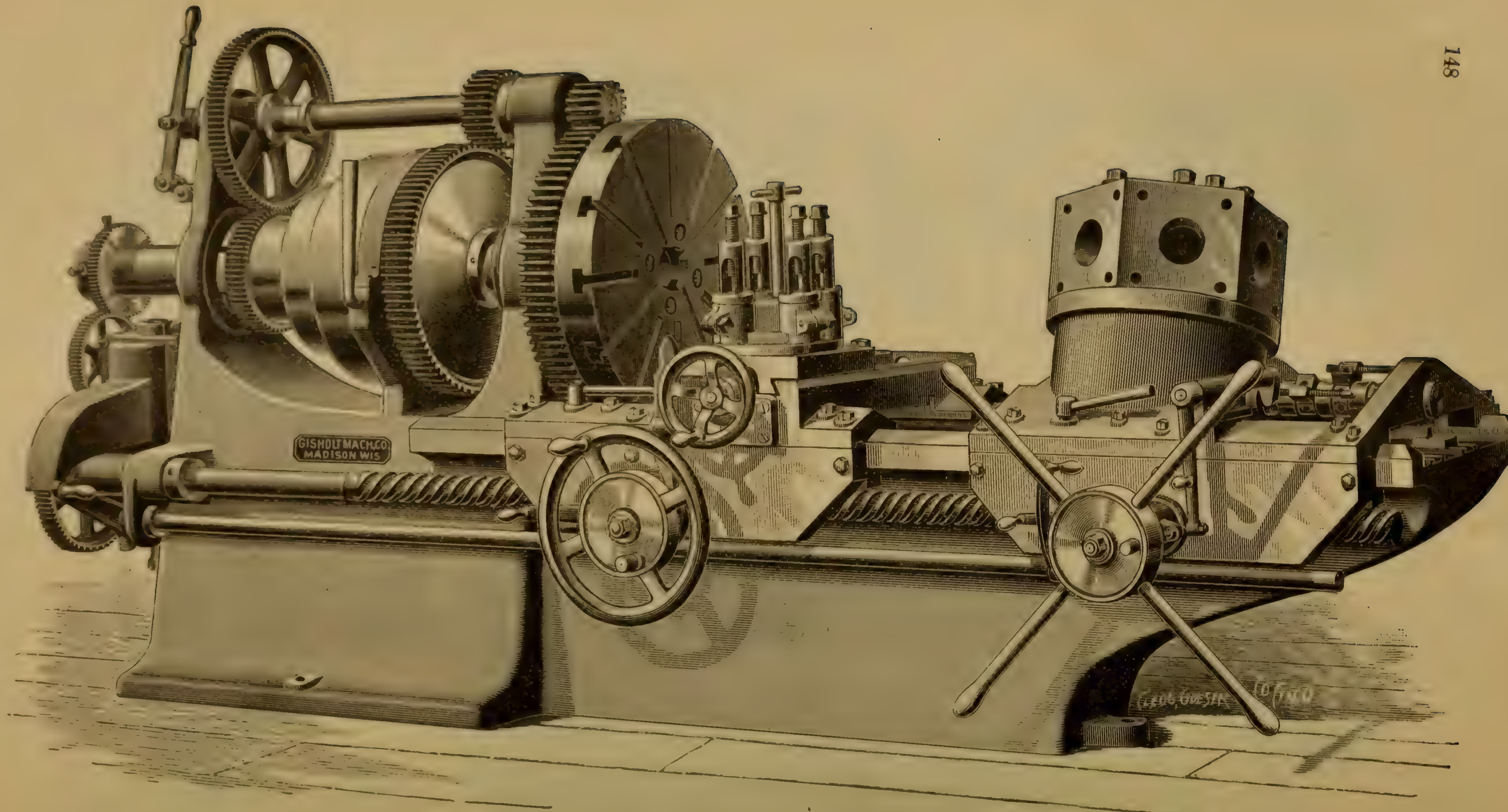
Diameter .... 6¾ inches.
Diameter hubs............ 4 inches.
Length .... 3¾ inches.
Bore........................ 1¾ inches.
Finished all over in 18 minutes.



TURRET ENGINE LATHES.

The Gisholt Machine Company, of Madison, Wisconsin, has conferred a public benefit in this country by making and introducing the turret or gauge tool system for a great variety of lathe work.

This country has been notably in the lead for thirty years past in turret machines for making screws, and a variety of other things, such as parts for watches, guns, and so on, by milling tools, but for some strange reason has not until recently extended the system to the wider field of common machine work for such parts as are made in duplicate, or even in general work.



Heavy Turret or Capstan Lathe.—The Gisholt Machine Co., Madison, Wis.

In this we are behind works in England, where for at least fifteen years past a great deal of work has been done by these gauging or turret lathes, using common tools the same as for ordinary engine lathes.

The processes we are trying to describe consist in accurately setting a number of tools on a turret, or by "presenting" devices so that the tools can be used repeatedly without fresh setting and adjustment each time they are wanted.

It is a method not entering into the use of a common engine lathe, where each tool as it is wanted must be set in the machine and adjusted each time it is used. In this turret-tool system the slide rest or supporting elements are not in the axis of the lathe, as in the case of milling tools, but set to one side, so the manner of cutting is analogous to that of engine lathes, and, as seen in the drawing, the turret can be employed in conjunction with a traversing slide rest for cutting off, facing, or other operations normal to the axis of the work.

In English shops where the turret system is carried out, the work is divided into two classes, one for common engine lathes, and one for turret lathes. The draughtsmen know what kinds of work are suited for the turret shop, and such pieces are drawn on separate sheets, and so marked, and by thus segregating the work, and by constant practice the turret men or boys become so expert in adjusting the machine that in cases where six or more pieces are to be made alike they are included in the turret class.

Some years ago we sent to a well-known English firm and procured some examples of turret-lathe work just as they came from the machine, with a list of prices for each piece, but it seemed incredible, and produced no result, the fact being that at that time there was so little work done here that required duplication, people could not see the advantages of the system.

The Gisholt Company send illustrations of work done, as seen in the drawings, with, in some cases, the dimensions and time of making marked below. There is sent besides the following data in respect to making some familiar parts of machine work.

For example, a step pulley with three faces, 6⅜ inches wide, the pulleys 12, 18 and 24 inches diameter, with an extension of the small pulley, making the total length 23 inches. This pulley, having over 1,200 inches of surface, was turned all over, except the inside of the two small pulleys, in 3½ hours, or, as we estimate, one fourth of the time required to do the same work on an engine lathe.

Another example is a bonnet for the valve stems of Corliss engines. The base or flange is 10 inches square, large diameter 8 inches, length over all 19 inches, for a 2-inch stem, bored and finished in 1¼ hours.

The drawing shows one modification of these lathes, which are quite different and much heavier than those used in England, but a drawing of the machine in one position, or in one adjustment does not cover more than a single idea of the scheme. They are modified in various ways, and adapted for making valves, gear wheels, studs, and so, but are convertible to almost any work in machine fitting. A number of these lathes have been supplied to firms in Europe, and their manufacture is a credit not only to the makers but to the industry in general.

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

This association held its first regular meeting for 1895, on Feb. 1st., when reports of the officers and other routine matters of business were well transacted, after which Mr. G. W. Dickie, the newly elected President of the Society, took the chair, and delivered a suggestive address, confined mainly to a review of the industrial affairs of the Pacific Coast, and the relation of the Society thereto.

We are unable this month to give the whole of this address, but will quote the closing portion in respect to the commerce of the port, as follows:

"Naturally, California is well fitted to be a great commercial and manufacturing State, with a climate well adapted to the prosecution of every kind of manufacture. With a soil that richly repays the labor bestowed upon it, and set right in the centre of its great coast line, one of the finest harbors of the world. Why should we not take a better position than we do now in the manufacturing industries of this country, and in the commerce of the world? Our merchants, most of whom came here from the Eastern States, to open branches of houses established there, have kept on doing business with their faces turned toward the east; have built their business houses with their fronts facing in the same direction, and standing in their front doors, wondering what has become of their business. They can see nothing but the railroad, with the towns along its route getting their supplies from the west bound trains, because they happen to be at the far end of it.

Now, if these merchants would just turn their business houses around so as to face the other way, they would be at the beginning of the railroad, instead of being at the end of it, and loaded trains would leave their back doors, instead of empty cars standing at

their front doors, and the railroad would do just as well hauling east as hauling west.

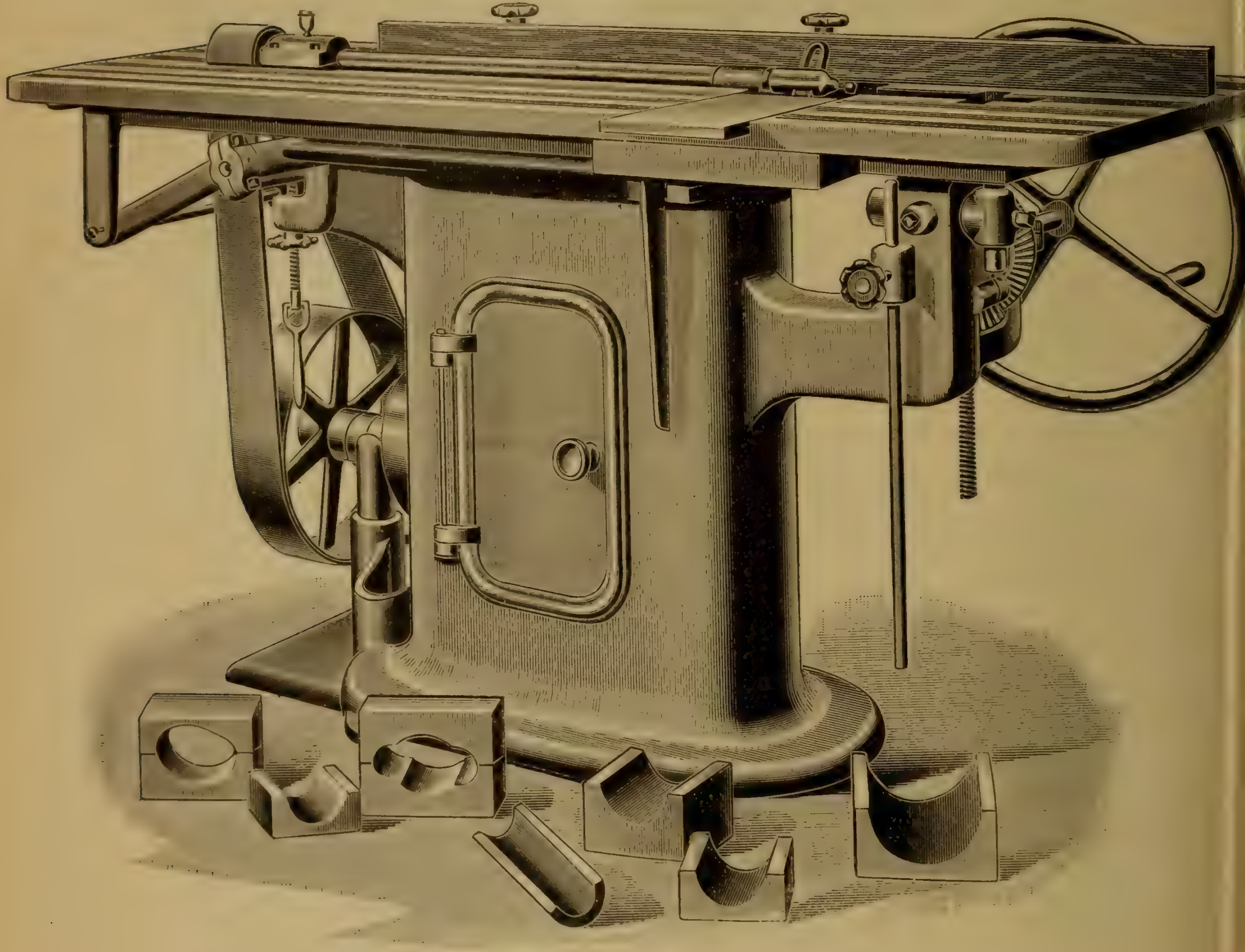
It is not necessary here to point out the means by which this change is to be accomplished. I have already done this, as far as the matters on which I have any knowledge are concerned; but my proposals have hitherto been in advance of any desire on the part of our merchants to profit by them.

To-night I desire to enlist all the members of this Society, and all those whom they can influence in a united effort, to help revive the manufacturing industries of this State, and the commerce of San Francisco. Every influence has an effect, and we can all do something in this direction. Consulting engineers should advise their clients in regard to favoring the products of our establishments. Nothing but an inability to produce the article required should be an excuse for its being made elsewhere. We can never be prosperous until we supply a larger percentage of our requirements from the results of our own labor. A large portion of the youth of our State are now growing up in a condition of enforced idleness, which adds to the already heavy burden of the few who have the opportunity to work. We are opening schools for manual training in the mechanical arts, and at the same time closing our workshops. What good will come of teaching trades in our schools and not fostering the practical application of such knowledge in our industries? There is a young generation, to say nothing of their fathers, begging at our shop doors today for the opportunity to earn a living at their trade; but the industrial wheels are either stopped, or moving so slowly that there is no chance for them to work, and this is a young State with vast resources undeveloped, and which from her position should control the trade of the Pacific.

The Technical Society may not be able to accomplish very much in the direction herein indicated, directly, but such societies have an immense power indirectly. Our members are being constantly brought into contact with business men representing large interests, and their advice and opinion very often goes much further than the party giving it is aware of.

Let our influence be exerted continuously in the one direction of helping by every means in our power, the growth and development of our home industries. Well directed efforts patiently kept up by technical men, will ultimately result in the formation of a sentiment that will pervade the whole community, making legislation in the right direction possible, and when once our people understand the possibilities latent in the resources of this great State, there will be an awakening of domant industries. Our merchants will find new markets for the products of our skill, and instead of driving labor from the closed doors of our factories, we will be inviting the idle hands of other States to help us meet the wants of customers in every land that looks on the Pacific."

Mr. Ernest Rossow then read a paper on "Traction Engines for Common Roads, Impelled by Steam and Petroleum Engines," in respect to which there was some discussion.



CORE BOX MACHINE.

JOS. A. CRANE & CO., ROCHESTER, N. Y.

The machine above illustrated is one that has been a long time in appearing. As pattern work is not a commodity to be sold, and not one of competition, it is natural that the struggle for labor-saving appliances has not gone on in this as in other branches of mechanical work. Lathes are a necessity, so are saws and planing machines, in a sense of avoiding hard work, and it is not far wrong to say that pattern makers have stopped with these implements and do not think of any more. An exception to this are the dimension sawing machines made by Mr. B. D. Whitney, at Winchendon, Massachusetts, extensively used in pattern work in Europe.

The peculiarities of these machines are that the work, whatever it may be, is cut at once to exact or finished dimensions by the saws irrespective of the grain, and smooth enough to be sand-papered and varnished without planing.

It is not very easy to keep the flask maker and packing box people away from these machines, and a great share of pattern makers cannot understand and take care of such saws, so we sometimes find a fine dimension machine employed for cropping up boards and the like, the same as a common saw bench.

Pattern work is not uniform; no two things are alike, because only one can be required. This has limited the application of machine tools to this work, but there is one part that has some uniformity and should be made by machines whenever possible, that is, cylindrical core boxes. Working out core boxes, which is supposed to not require much accuracy, is commonly not very well done unless they are made on lathes. The work is tedious and hard too, if the cores are large, and as said at the beginning, the wonder is that core-box machines have not sooner appeared.

Messrs. Crane & Co., the makers, send us the following statements respecting the machine shown in the illustration. It is exceedingly well designed, provided with convenient and rapid adjustments, and a credit every way to the makers.

"This machine is adapted to the making of patterns, core boxes, pulley bushings, etc. It will groove a semi-circle core box absolutely true in a few minutes, where hours and sometimes days are required to do the same work by hand; cut grooves from ½ in. to 20 in. in diameter, any length; form any internal circle work on exterior of patterns, such as inside of staves, making coves, or cut inside of round boss so as to fit perfectly the exterior of a round pattern; will cut with, across, or on the end of the grain, and leave the edge smooth and clean. In pattern work it does away with a good deal of work that is now done by hand, and can be used for many different purposes.

The machine is of substantial design; frame is made in one solid casting, spindles are made of steel, and consist of main spindle, to cut from 1¼ to 20 in. diameter. An extension spindle is fitted to the main spindle, to enable the operator to cut small grooves from ½ to 1¼ in. diameter. Self-oiling brass strap box at the cutter-head. Spindles are driven with an endless belt, and the counter-shaft is adjustable so as to keep the belt at proper tension. The cutter-heads are of brass, provided with single or double adjustable loop cutters. Weight of machine, 700 pounds. Floor space required, 36 × 20 inches. In any case where there is work enough to keep one of these machines running constantly, it will pay for its cost in one week."

EXTRACTS FROM A NOTE-BOOK.

BY "TECHNO"

No. XXVIII.

A SAINTLY CITY.——SIX MILES OF STEAMBOATS.——A FALLEN CITY. CHARLES MACKAY ON THE CRESCENT CITY.——A TOP DRAINAGE SYSTEM.——A PAVEMENT FOR 200 YEARS.——CARPET BAGGERS.——RIVER PIRATES.——A BRIDGE 22 MILES LONG.——ON FLAT BOATS.

——St. Louis, now a great city, founded in 1746, nearly 150 years ago, named, it is said, after Louis XV, who was no saint, indeed was quite the opposite of a well-regulated saint, and considering its environment, is a small city. It was transferred to the United States in 1804 from its French owners, and should now be the main city of the United States, and would be if there had been no railways, but these converted it to a way station. In 1852 there were 100,000 people here, now 450,000.

The old steamboat levee in 1860 was six miles long, and as many as one hundred and seventy steamboats have been counted there at one time. This seems an enormous number, but when one begins to count up water courses the wonder is there were not more steamboats. Let us count up this mileage, or the main part of it. The Missouri River, 2,000 miles; Mississippi, upward, 750 miles; Mississippi, downward, 1,300 miles; the Ohio, 1,000 miles; Red River, 1,100 miles; White River, 400 miles; Tennessee, 300 miles; Cumberland, 300 miles; Wabash, 300 miles, in all, of free-water course, navigable for large boats, 7,450 miles; to which can be added enough in smaller rivers to make up 10,000 miles. Suppose that railways had not been invented, and all this commerce was confined to River cities, what would Cincinnati, St. Louis and New Orleans be now?

New Orleans, the Crescent City, is like Babylon the fallen. It is not the city it was at one time, and can never be again. Even if its commerce should under modern methods rise to the same volume as thirty years ago the place would in no sense be the same. The city has not declined so much as the people have. There was always much crime there, principally violence, but this has given way to quiet rascality taught by the circumstances of war, and principally by the "carpet-bag" regimé and the Freedman's Bureau, by means of which the carpet-bag officers gained their places.

Some years ago an Act was passed by the Louisiana Legislature by which the public money in New Orleans had to be dispensed through, or by, a private organization called the "Draining and Paving Association." Think of a town so currupt that the citizens could not be trusted to handle their own money.* The French part of the city, one half of it in former times, was proverbial for honesty. No one thought of being cheated in the French quarter. Now it is different, and these Creole-Frenchmen are as bad as their Saxon instructors. Like Bret Harte's "Heathen Chinee" their ways are peculiar. I do not want to say anything wrong of New Orleans, and regret that these facts and opinions are gathered from people there, good people too, among them a member of Congress, who knows everything of the internal working of that municipality.

The city is filled with rain-water tanks, to escape thereby the extortionate water rates. The supply is lifted from the Mississippi in front of the City at a mere nominal cost, but is sold at the highest rate of any city in America, and what is more, people are compelled to buy it. We were shown a large brewery that laid pipes to the river for the water used, and had to abandon them because it was an infraction of the water company's charter. It is scandalous.

Charles Mackay, who in 1859 wrote a very interesting account of a visit here, thus describes New Orleans at that time:

"The river can scarcely be seen for the crowd of steamboats and of shipping that stretch along the levee for miles, and the levee itself is covered with bales of cotton and other produce, which hundreds of negroes, singing at their work, with here and there an Irishman among them, are busily engaged in rolling from the steamers and depositing in the places set apart for each consignee. These places are distinguished one from the other by the little flags stuck upon them, flags of all colors, and mixtures of colors and patterns, and here the goods remain in the open air, unprotected, until it pleases the consignees to remove them. New Orleans would seem at first glance to overflow with wealth to such an extent as to have no room for storage. The street pavements actually do service for ware houses, and are cumbered with barrels of salt, corn, flour, pork and molasses, and bales of cotton, to such an extent as to impede the traffic, and justify the belief that the police must either be very numerous and efficient, or the population very honestly disposed. The docks of Liverpool are busy enough, but there is no life or animation at Liverpool at all equal to those which may be

*As Techno's presentation of matters political in New Orleans may seem an exaggeration we print the following press dispatch to show that his statements are fully warranted:

New Orleans, Aug. 9, 1894. This City is likely to have a new government within thirty days, as it is thought that almost every member of the present government will either resign, or be convicted of dishonesty in public affairs. Francis Triffler, the most influential member of the Council, resigned to escape impeachment.—*S. F. Daily Papers.*

seen at the levee in the 'Crescent City.' The fine open space, the clear atmosphere, the joyousness and alacrity of the negroes, the countless throngs of people, the forests of funnels and masts, the plethora of cotton and corn, the roar of arriving and departing steamboats, and the deeper and more constant roar of the multitude, all combine to impress the imagination with visions of wealth, power and dominion, and to make the levee as attractive to the philosopher as it must be to the merchant and man of business."

Now there are only a few shabby-looking steamboats, no freight piled on the levee. A red hot stove would be stolen if left there now. I went through the French quarter below Canal Street, and don't think there is a house there less than forty years old. None have been built in that time, at least none worth considering, and the old ones are not kept in repair. The French, who once had a sprightly vivacious look, are now dejected and cunning. They are French no more, but a cunning, bargaining and insincere lot. My impressions were disappointing, and I adopted the usual refuge of asking my Uncle's opinion respecting the Crescent City. He knew the South well before the war, also, as I knew, had watched it since. He watches everything in fact, and commonly draws fair conclusions.

"New Orleans," said he, "had to be built here. There had to be a city at the end of this mighty valley, otherwise no one not a double fool would ever have thought of laying out a town on a marsh at water level. Why they cannot bury one here, the dead are put into mounds, like flowers in pot. The drainage is on top of the ground, as you can see, and you can take up a paving stone out there in the street, dig down a foot or so, and then run a cane fishing pole down whole length. You see that big building over there made of granite, that is the custom house, and has under it all sorts of contrivances to hold it up, including some thousands of cotton bales, so it is said. Well, that building has gone down about nine feet, and will continue to go. The St. Charles Hotel, where we are now sitting, has been held up pretty well. It is an old house, and has rested on piles, or at least partly so, but with all other known devices to secure flotation in mud.

"There are queer things here, many of them. Out there on Canal Street you see it is paved with large squares of granite, I suppose you think they are flag stones or veneering. No such a thing. These stones are cubes, with six sides to wear out. As soon as one side is worn another can be turned up, but you need not watch for that operation. The side you see has been in use for

thirty-five years, and is good yet. Six times thirty-five is two hundred and ten years of wear, and that will pay for quarrying out granite cubes in New Hampshire; and carrrying them here. A number of other streets are laid in the same way, and are the best paved in America.

"I suppose you are wondering where the drainage goes to when the river is higher than the city. It does not go that way. Behind here is a chain of estuaries or lakes, Ponchartrain and Borgne, connected with the Gulf. Salt water, and lower than the river, a little lower, but not much, but always at one level. The sewage is lifted by wheels back of the city, and thus given head enough to flow back to Ponchartrain, six miles away.

"New Orleans is not a river city altogether, it is in effect on salt water, and luckily too. If it were not the heat would kill one at night, unless the mosquitoes had not performed that office in advance. Six miles out from here is what makes New Orleans endurable in summer. Fine lakes of salt water, or brakish water, pure, clear and cool, with all the comfortable inventions known to modern taste and contrivance, gardens, music, restaurants, theaters, and other things, which a Frenchman alone could invent and maintain.

"Out of the old French, and still older Spanish element here, coupled with the Southern chivalry, which people sometimes deride, came to this city certain attributes of an advanced civilization, not quite extinct at this time, but greatly impaired. These old Southern folk had their good traits. They would shoot each other sometimes, burn a nigger now and then, consume a large amount of liquor, and swear like the army in Flanders, but they would not 'steal.' The carpet baggers taught them that, and a very sorry lesson it proved to be.

"You perhaps don't know what this term carpet baggers means. It indicates a public officer whose interest in the country was carried in a carpet bag; came here to get an office, issue public bonds, sell them, pocket the money, and clear out. Go out about here to any city, and the trail remains in the form of a bonded debt. Cromwell in Ireland is the only parallel I can think of. Austin, Houston, Mobile, Baton Rouge were taken in. Here in New Orleans there was veritable war, cannon, barricades, the U. S. Mint turned into a fort.

"At the end of the great Civil War the white people were all 'tore up,' as they describe it. They did not vote, in fact did not

dare to vote. The negroes were marched to the polls, and a stranger with a carpet bag became a mayor, others councilmen, and even a governor in this State, but to sum it up this political conquest of the South destroyed or stole more of her wealth than was lost in the Civil War. That is a strong statement, but is supported not only by facts, but admitted by any honest and impartial citizen whose opinion you may ask.

"But it had retribution. The North has suffered the same. The carpet baggers did not stop when they returned home, but set out to corrupt public affairs everywhere, and by machinations of all kinds have hatched up iniquitous schemes that have unsettled the industries and commerce of the country. You can get no correct idea of the South, or of New Orleans, in one visit, or even in six of them. You must call in forty years of history to do that, and moreover be impartial, which of itself is an undertaking few people are capable of.

"There were always pirates here, river thieves, that carried on a kind of Captain Kid business. They stole everything from fruit to fence rails, and from young chickens to horses. There was little of the common law machinery along the coast from Baton Rouge down, the code depending mostly on long range rifles and revolvers. The 'chicken thieves,' that is, small thief boats, prowled around the river. They had 'dug outs,' little light canoes, to go ashore in. They would go under the wharves here, and slit coffee sacks through the cracks, and draw down a canoe full of green coffee, paddle out to the thief boat, commonly a small sloop, and come back for another load. The men were foreigners, Spanish, Italians and Portugese mostly. When a planter saw one of these craft lying off his plantation he usually opened fire on them with a rifle. This was the only kind of stealing known here in former days, but they have fifty variations of it now, mostly within the pale of law, but no better for that, in fact worse. A thief under cover of the law, the church, or an army, is the meanest of all thieves, a real highwayman is a saint in comparison.

"The Belize is down a hundred miles or so from here. I don't know what the term means, other than the mouths of the Mississippi. There are three principal ones, and a dozen smaller ones, but fewer now than when Captain Eads built the mattress walls there, called jetties. He concentrated the water, caused a scour in one of the main channels, and produced twenty-six feet of water instead of fifteen, or so, that existed before. Very few go

down there, there is nothing to go for. The great river dies there, flattens out like a jelly fish exposed to the sun, and the waters flow into the ocean to begin a new round of fog and clouds, that are converted to rain up at the head waters, two thousand miles away. There is the same amount of water all the time, but it shifts around."

————The greatest feature of this country here, and for two hundred miles above, also for an unknown distance each way, is swamps. Going out to Lake Ponchartrain, six miles or so on the shell road, a veritable road made of shells, the swamps are on each side. What it means I cannot make out. That the land and water should have arrived at levels so nearly the same, and remain there for ages, as the great trees attest, is a strange thing indeed. The lakes, or at least Ponchartrain, are only a little lower. Straight across this lake, twenty-two miles, the Cincinnati Southern Railway has driven piles and built a bridge. Think of a bridge twenty-two miles long, but it is there. Raise the bed of this lake a few feet, not more than six, and, except a channel here and there, it would be a "swamp," and bear huge trees, be covered with jungle and reeds, beneath which, and among which, would swarm all kinds of life of the least desirable kind, serpents, mosquitoes, alligators, snapping turtles, and other things of a creeping and venomous kind.

————I heard the term "flat boat" a good many times since coming into the Mississippi Valley, and had some idea of its meaning, but not very clearly. Last evening a man remarked: "That was in flat-boat times," indicating an age when this species of aquatic craft flourished, so I lost no time in asking an explanation of my Uncle, who was good enough to go to the bottom of the matter.

"A flat boat," said he, "is a western invention, is a punt a hundred feet long, or, to be more exact, is a rectangular water-tight box, sixty to a hundred feet long, eighteen to twenty-two feet wide, six to eight feet deep, and is the cheapest means of moving freight ever devised in the world, if we except rafts, and these need not be excepted, because they are in the water, while a flat boat conveys its load dry.

"Of course you never saw a flat boat built, and never will. They were an evolution of this valley, and not known elsewhere. Get out that note-book, and I will go over the process. It will not involve the calculus, or quadratic equations even. I will not touch on radiant matter, electrical hysteresis, or the fourth dimension, still

the art deserves a place in that note-book among other imperishable facts to be dug out at some future ages, as we now decipher the runes of Gothland.

"To begin, suppose two or three men that you would call farmers live on one of the small tributaries of the Ohio River, for example, have during the winter months 'cleared land,' and in so doing have prepared a hundred cords of hard wood, that is, beech, maple and hickory, also have some bacon, hoop poles and tan bark, perhaps corn, pumpkins, dried fruit, shingles, cedar posts, or other commodities to sell. These things are worth money at Cincinnati, Louisville, or other cities on the river, and worth nothing whatever on the ground where produced. Steamboats cannot come there, and hauling is out of the question, so these men take their axes and go out into the forest to hunt up a 'gunwale tree,' that is a tulip or poplar, as they call it, large enough to make a pair of gunwales, or 'gunnels,' to construct a flat boat, called sometimes a 'broad horn.' Up to sixty feet long, or even eighty feet long, one tree will do, but the longer gunwales have to be spliced.

"The tree is felled, and squared by hewing to lines, twenty or twenty-four by sixteen inches. This beam, weighing tons, is then raised six feet or so by rocking it on a crib on the see-saw method, and is slit edgewise into two parts with a whip saw, and here is another explanation about these saws that I will go into some other time. These gunwales 8 × 20 inches are then dragged down to the water's edge, and set on their edge on launching ways. Each end is beveled off for the rake, end beams are framed in, so also cross timbers about 5 × 8 inches laid flat about six feet apart, tenoned and draw pinned into the gunwales four inches below the edge. Next there is pinned on these 'stringers,' about 2½ × 6 inches, running fore and aft, three feet apart. These will be one and a half inches below the gunwale, which is then rebated to let in the bottom planking, one and one half inches thick, put on crosswise, everything pinned with hard wood trenails about one inch in diameter.

"The boat is then caulked with tow or oakum, butt and main seams pitched with tar, and is ready to launch. The gunwales are raised with levers, some greased slide boards put on the ways, and the immense shallow box is shoved into the water, and here comes a puzzle. The boat is upside down, and must be turned over. To do this some planks are set up along one side, and the bottom is loaded with stones and earth, stones alone if there are enough at hand, until the boat is sunk below the surface of the water several

inches, the projecting stones providing buoyancy. This nondescript creation is then moved into deep water, in a 'hole,' as they call it, and a number of people standing on the bottom begin, as fast as possible, to pitch the stones to the side having the guard plank. In a few minutes that side begins to sink. The stones all slide over to the low side and the boat turns over. The people in the meantime rush to the high gunwale and crawl over, or else swim out of the way, which is the true conventional custom. The boat is then towed back to the shore, baled out, and is ready for studding. These are mortised into the gunwales, about three feet apart all around, the side planking is put on and caulked.

"If to carry dry freight, a roof is sprung on, that is, curved about half an inch to a foot, the boards crosswise and full length. If cord wood, timber, hoop poles, staves, coal, or other freight not needing cover, is to be carried, the boat is left open, and is ready for loading as soon as the sides are put on. The draught will be two to three feet for a dry load, for timber of any kind about four feet. If for coal, stone or other mineral, the draught may be nine feet.

"A 'check post' is set in, and braced by the cargo. The sides are held out against external pressure in the same manner, indeed the whole thing is only a water proof covering for the load. An immense 'sweep,' fifty to sixty feet long, is mounted at the stern for steering, and a pair of shorter sweeps for pulling headway, which in extreme cases may reach half a mile an hour.

"This great ark floats to her destination, steered carefully. 'How?' you will ask. In the strong current and slope of the river the boat crawls through the water, not as fast as a North River steamer, but at a rate of one to two feet a minute. How and why you may find out for yourself. The main thing is stopping these boats in a current of five to seven miles an hour. To do this requires skill, dexterity and good judgment. To land, the bow of the boat is set quartering down stream. A rope 200 to 400 yards long is coiled in the stern of a skiff. A good man takes the oars, and the most active and coolest one at hand takes charge of the line, which runs out over the stern as the skiff is rowed ashore. As soon as the skiff strikes the shore the rear or line man turns over the rope coil, seizes the free end, springs past the oarsman, and runs up the bank to find some solid object to make fast to. A tree or large root, or some immovable object. A 'let go' hitch is made, and the signal given to begin 'checking,' which is a dangerous operation. About three turns are made around

the check post, and the line fed out under such tension as it will stand. The smoke will sometimes rise from the post, caused by the friction. The boat begins to swing, and at the same time move toward the shore, and is gradually brought to rest with the bow or end up stream. If there is too much delay, and remember all this has to be done in a minute or two, the check man cries 'let go,' and the line man casts off, comes on board, the line is hauled in, and another attempt made after the boat can be moved out and again laid in position.

"This is often done in the night. Landings are made, indeed must be made, at city wharves. The line man must find a ring bolt, the water-wheel beam of a steamboat, anything in sight to make fast to, and he does it. Protests do not go, he will hitch to anything, and fight to retain his hold. Remember he must be ready to let go at a signal from the boat. If his hitch gives way he is disgraced, if he cannot let go he is disgraced, if he falls in the river and don't drown he is disgraced. The ethics of the trade are distinct. You may laugh, but I would rather go aloft to furl a royal in a gale than to go out with a flat boat check line.

"At the end of the journey the boat is taken to pieces, and sold as sawn timber. The cost in former times was from $1.00 to $1.25 a lineal foot, and the wrecking value half as much or more. It is all done now; railways reach the inland streams, timber is too dear to build flat boats with, and the men who operated them are in the cemeteries.

"If one of these arks touched any object harder than water, sand or mud they crushed like an egg shell, and if loaded with coal settled down on the bottom with such celerity as to take the crew along. If loaded with timber they filled but went on, and a discount was made for the drowned timber, covered with slime from the river water, which is loaded with clay during the winter months. The emergency came when there was ice in the river, a temperature nearly zero, and a wet rope would become as stiff as a gas pipe in ten minutes, and when a line man got in the river he was 'done for.'

"You will set this down as queer navigation. So it was, but it was not the most dangerous of this country. Some time I will describe the other, I hope in less words."

I am beginning to think that water-craft, that is human craft on the water, is much the same as it is in animals. It is absorbed in an insensible way throughout a term of years, or a lifetime, and is not a specific thing to be learned, like building houses or shoeing

horses. A kind of second nature. Put a water-skilled man on a steamer, a ship, in a boat, on a raft, or a life buoy, it is all the same. He knows the traits and trends of the water, and how to keep on the surface of it. Geometry, dynamics, mechanics, or even a knowledge of Greek and Hebrew, will do him no more good than a heathen's talisman, unless he has been trained to the water, on and in the water. It is like gymnastics and circus riding, no one can do even a little of it without training, and they must begin young. There is a touch of heredity in it too. I do not mean what is called navigation in its technical sense, finding the way in open seas. That is a science, and not a very abstruse one at that, but how to clubhaul a ship, or land a flat boat.

(To be Continued.)

ENGINEER JONES OF THE MEXICAN NAVY.

[BY BREVET.]

Chief Engineer James H. Jones, of the Steamer *San Rafael*, known by all travelers to the Marin Peninsula, and one of the best known around the Bay here, is an officer by brevet in the Mexican Navy, since 1859. It is a curious and interesting story, now after more than forty years brought into pleasant memory by a visit of Engineer Jones to the City of Mexico about ten months ago, where he was shown distinguished courtesies, invited to the offices of the President and Secretaries of War and the Navy, and again thanked by the Mexican Government for certain services rendered in 1859.

The story is related by Engineer Jones as follows :

At the time named the Miramon rebellion in Mexico had succeeded to such an extent that nearly the whole country was in the hands of the Church party, as it was called. The City of Mexico, the Government records and personnel had been removed to the fortress of San Juan d'Ulloa, at Vera Cruz. This fortress too was beleagured by the Miramon forces, but they had run out of ammunition, and awaited a supply to be sent out from Havana, supposedly under connivance of the Spanish Government.

Two steamers, the *General Miramon* and *Marquis de la Habana*, were fitted out with stores, ammunition, and a deck armament, including a 32-pound gun, and started down the Mexican coast, calling wherever there was anything of importance to capture or reduce,

but with a main object of delivering supplies at Vera Cruz, and assisting in the capture of that port. They knew well enough there was no Mexican vessels, or other means, to oppose them at Vera Cruz, and sailed past the entrance to the harbor about five miles off, refusing to answer signals from the fort of San Juan de Ulloa, also from the American war frigate *Saratoga*, then lying in the harbor there.

The *Saratoga* had been sent down there by the United States Government to render any assistance they could to the Juarez party. She was commanded by Captain Turner, afterwards Commodore Turner, of the U. S. Navy, and among her officers was Lieutenant Irwin, now Admiral Irwin, commanding at Mare Island Navy Yard.

When the two steamers sailed past Vera Cruz to an anchorage beyond, the *Saratoga*, being a sailing vessel, could do nothing, and Captain Turner decided to seize the *Indianola*, a United States merchant vessel plying between New Orleans and Mexican ports, and then in the harbor at Vera Cruz. Mr. Jones, then a young man, was first assistant engineer on this steamer.

When it was rumored that the *Indianola* was to be seized, and sent out to investigate the two steamers in the offing, the crew, as the saying goes, "smelled a rat," and straightway gathered up their "togs" and left for the shore. It was well known that the steamers were fully armed, and that the chances were that a good many who went out would perhaps come back in the cock pit ready for interment, and the merchant crew being peaceable men did not feel called upon to perform any such dangerous duty.

Engineer Jones stuck to the ship, he wanted to "see the show," as he said, and was almost the only officer left when Captain Turner's men came on board. They inquired for the engineers, and were informed by Mr. Jones that the chief had gone ashore, but he was first assistant, also that he did not like to assume charge of the machinery in the absence of the chief, on the grounds of marine etiquette. Will you be here when we return? said the naval officer. "I am a descendent of Paul Jones, and you will find me under that flag as long as there is a deck here," said Jones, pointing to the ensign.

The officers of the *Saratoga* thanked him, the men cheered, and the crew from the *Saratoga* went back to that vessel, soon returning with several howitzers and other war tackle required to convert the *Indianola* into a war vessel. The bulwarks were cut away, the decks bored for gun lashings, and in two hours the merchant steamer was

a gunboat of a formidable kind, armed with the howitzers, a body of marines with small arms, ammunition, surgeons, and the rest.

Jones had steam up; the *Indianola* took the *Saratoga* in tow and started out to the two steamers of unknown purpose. The water was too shallow for the *Saratoga*, she was cast off, and the *Indianola* steamed up near to the two vessels and hailed. The answer came promptly; a 32-pound shot that happened to take the purser's cabin on the *Indianola* diagonally, and did not leave much except the ship's safe. The fight began in earnest, the *Indianola* steaming around the two Mexican ships in a circle. The Americans were superior in small arms and in ordnance, except the 32-pound gun on the *General Miramon*. A lucky shot from the *Indianola* carried away the mountings at one side of this gun, and disabled it. After a fight of about two hours the vessels were boarded and the capture was complete.

The *Miramon* was punctured at the water line in several places by the howitzers, and was making water. Engineer Jones went over the side in a sling, and with some copper, found on board, patched the holes so as to save the ship from sinking. The two vessels were taken in tow, and carried into the pier at Vera Cruz.

On landing, the infantry forces of Juarez were drawn up in lines, Engineer Jones and his assistant passed between at "present arms," and at the end of the lines were met by the government officials and embraced, in token of the great service rendered.

Engineer Jones was pronounced a Mexican naval officer by brevet, and should have been assigned to some place of honor and profit, but he was sent with the prizes to New Orleans, and reached there just in time to find service in the United States Navy for the Civil War, then imminent, and which soon came, and this is how Engineer Jones when in Mexico last year was entertained and honored as a Mexican naval engineer by "brevet."

On his calling on the United States Consul at the City of Mexico last year, that official sent him at once to the American Minister, who, after reading several letters presented, including one from Admiral Irwin, said : "I will present you to the government officers, as a courtesy, but the facts and these credentials render my aid superfluous."

Republics are proverbially ungrateful, but we have no doubt now that Engineer Jones has made his whereabouts known some kind of substantial acknowledgment of his services will be made.

AUSTRALIA.

Consular Report No. 168, Sept. 1894.

These valuable documents have nearly caught up, so to speak, and are issued within three to four months behind the receipt of the matter at the State Department.

The present number contains a number of communications on the eucalyptus tree in various parts of the world; on foreign trade in American flour, and copious reports from U. S. Consul Geo. W. Bell, at Sydney, Australia. The Consul, in a short article on the commercial importance of Sydney, furnishes some facts that are astonishing.

The foreign trade of New South Wales is $240 per head of population, and the wealth of the country is $1,620 for each person, the highest in the world; Victoria following with an export trade of $182 per head, and a wealth of $1,520.

The population of New South Wales is only 1,200,000, and their foreign trade in proportion to population is nine times as great as that of the United States. In 1893 the entries and clearances of vessels at Sydney was 5,830, or sixteen for every day in the year. Of these vessels 4,658 were steam, the total tonnage being 5,193,328, and the value $170,000,000, more, perhaps, than any other city of the size in the world. The population is about 400,000.

The Consul says there is a surplus of things deficient in this country, and a surplus here of things wanted there, but our trade is less than three per cent. of the whole, which is remarkable when we consider the relations, geographical and other, between the two countries.

The Australian crisis of 1893 continues a fertile topic, and Consul Bell devotes twenty-three pages in the present report to this subject. Everything written of the matter is instructive and useful in this country, which is in comparison conservative and unwieldy. Reforms, changes and improvements are bolder there, carried out in a fraction of the time, so that precedents are worthy of a careful consideration.

The banking capital of Australia, for a population of less than 4,000,000, was $549,133,769, including coin, deposits and surplus assets. The coin alone was $100,000,000. The amount per capita was $185, against $120 in England, $80 in this country, $35 in

France, $30 in Germany, and $30 in Canada. In coin reserve the Australian banks were five times stronger than England, and about six times stronger than other commercial nations, but all this had to succumb to the vicious system of speculation and inflated values.

The "deluge" came in 1893, and here appeared a wonderful difference in methods of the governments. The Victorian government, always acting on the paternal idea, declared a general "holiday" of five days when the bank crisis came. This did no good, possibly harm. The government of New South Wales was wiser than this, and under an Act of Parliament declared by proclamation that the notes of certain banks in Sydney, five in number, should be a legal tender in payment of all dues for a term of six months.

The effect was magical, failures ended. Other wise enactments followed, by which the Colonial Treasury assisted the banks and their creditors. In other words, the Colonial Parliament was called together, and went at work as business men to redeem the credit of the banks with all the powers of the government. It was a great exhibition of the benificient powers of a responsible government, where personal interests and party ideas were laid aside, and functions strained to the limit of the laws.

Such procedure would have been impossible in any government where the legislative functions are in the hands of lawyers and politicians instead of business men, or those with knowledge of financial matters.

The most interesting and instructive part of Consul Bell's report relates to the causes that led up to the crisis of 1893. He shows that the public debt had nothing to do with it. The interest on government loans at four per cent. amounts to $10,800,000 annually, but to compensate this the revenue from public property created with this borrowed money amounts to $13,770,000, leaving a profit of more than $3,000,000 on the public debt, so other causes must be sought for.

These appear in various forms, such as large land holding, an open purse in England, the alienation of lands, of which 21,884,299 acres are held by 677 persons, or an average of 32,000 acres each. We cannot, however, follow through this wonderful story, but will quote a short section as follows:

"People for years had been coming moderately fast, but the money was coming faster, so it became a custom to bank on the future. Stations were bought at high prices, the sellers moving to the cities; factories were built, and a series of city booms gradually

grew proportionately with the inflated ideas of the people. Loan agencies, building societies, mortgage and trust companies, and every scheme conceivable were invented to create desires for growth and development. But the money still came faster than the people, and houses were built before there were people to give them value by wanting them. Cities were growing everywhere. The growth of Melbourne has no parallel in the United States except Chicago. Sydney arose like a dream, and in all portions of the country the excitement of creation went on Men built houses, but the weeds grew on the doorsteps, and the walks were silent. Men built, but men entered not in. Land was bought at fabulous prices, streets were paved and not used. Great rows of business blocks and pretty cottages await those who still long and struggle on the opposite side of the globe. In Melbourne, I am told, there are twenty thousand empty houses; in Sydney five to seven thousand. The houses are facts, they are paid for by somebody, and silently stand as monuments to enterprising folly. It is safe to say that there is property that cost fully £20,000,000 ($97,320,000) in the two cities that is now unproductive and waiting to have the element of real value attached to it by the presence of people who are either not in this country or, worse, not able to occupy it: for it must be remembered that want or desire to create value must be coupled with financial ability to satisfy the want."

The *Wood-Worker*, to whom we look for new ideas and progress in the extensive art it represents, says: "The under-head-first idea seems to have taken hold of our planing machine makers all at once; nearly every new machine has this feature." By this is meant placing the first cutting cylinder of a planing machine beneath the timber, in advance, and making a "face" first thing. Our advocacy of this has been so persistent as to call out rebuke. We are waiting, however, and as soon as all the machines are thus arranged, another problem is to be raised as to what the last under cylinder is for? With fair chances we hope to see the day when American makers can send their machines out into the world without being answerable to the charge of feeding them the wrong way, or planing the timber upside down, also to see the time when, by a proper arrangement of the cutters, smoother and faster work will be attained.

PUBLIC WORKS IN CALIFORNIA.

We are favored by Mr. C. E. Grunsky, of this City, consulting engineer to the State Commission of Public Works, with a report on the "Drainage of the Valley of California," as stated in the letter of conveyance, meaning thereby the valleys of the Sacramento and San Joaquin Rivers and their tributaries.

The present work, which is a very extensive one, including a large number of topographic maps and charts, is principally the work of Messrs. Marsden Manson and C. E. Grunsky, well known civil engineers of this City, and consulting engineers to the Commission. The Report includes an extensive appendix, contributed by Mr. Grunsky, on the volume and gauging of California rivers. This latter named section embraces thirty plates, illustrating velocities, volume and methods, based on work done by the State engineer department from 1878 to 1887, in which work Mr. Grunsky participated as an assistant to the State engineer, Mr. Wm. Ham Hall, C. E.

The objective point of the work, contained in the present report, is the reclamation of overflowed lands, and conservation of the Sacramento and other navigable streams in the great valley. A principal point is to enable concerted action, in accordance with some predetermined and comprehensive plan, instead of isolated and independent effort, which has not succeeded as it should. These overflowed lands in the great valley, estimated at 1,750,000 acres, were ceded to the State by the General Government in 1850, and the Legislature attempted by various acts to induce reclamation and settlement, mainly upon the islands or lands surrounded by channels, and in various ways have expended $3,191,588 in the work.

The U. S. Government, in the interests of navigation, has expended in the valley $1,115,696, and the districts, private, and organized under the State laws, have in their private or independent capacity expended in the Sacramento Valley $9,870,654. In the San Joaquin Valley $3,912,810, making up a total of more than eighteen millions of dollars, that have been devoted to this work of reclamation or conservation of overflowed lands since 1850.

The incentives and tendency to push the line of cultivation into sedimentary lands is strong the world over. Such lands are commonly beds of detritious matter, fertile to a degree incomparable

with higher areas, the depth of the soil permitting growths of grain, fruit, vegetables and hay, that in a few years or even in a single year may re-imburse a considerable expense in constructing retaining works to protect the farms from floods.

The scheme presented by the engineers of the board, are relief or by-pass water ways, to supplement and relieve the main channel of the Sacramento River. Above the mouth of the Feather River there are canals on each side that drain the Butte and Sutter basins on the eastern side, and the great areas of the Colusa and Yolo basins on the western side. The upper system, so to call it, converges on a point below the mouth of the Feather River, from where an enormous water way will lead from the Colusa basin to Rio Vista, where the waters will again join the main channel and flow into Suisun Bay.

This final or main section, requires a maximum width of 4,500 feet to convey 130,000 cubic feet per second. The estimate for this work is $9,287,000, and is perhaps $10 to an acre for the lands that will be reclaimed.

The scheme as here presented, has many things to mark it as conservative and commendable. To proceed in any manner to augment the channel and capacity of the Sacramento River is useless, because of the disturbing action of tide water, and subaqueous operations would render such a work uncertain and estimates for it impossible, so there is no choice but a by-pass system, which circumstances favor in every way. Some places as in Yolo basin, the work would have to be done through submerged areas, but as the whole would in any case be carried on by means of pontoons and floating plant, this would not make much difference.

The estimate seems a moderate sum, compared to the stupendous work proposed, but it follows certain rules, the only means available, but would most likely be much exceeded. A legislative bill is now prepared, forming a vast reclamation district under five directors, to be appointed by the Governor of the State. These directors will represent each a division of the district. The cost of the enterprise will fall mainly on the land drained, but partly on the State, and this latter we suggest should go no farther than the accretion of taxable values and revenues likely to be returned by enhanced values.

The financial statement for the year, by the Secretary of the Board of Public Works, is like some others, that of the Mining Bureau for example, incomplete, because it omits the printing and

map work, which is no doubt charged to the State printing account. Aside from this, it shows $20,318.70 expended from August 12th, 1893 to December 1st, 1894. The Commissioner's salary, amounting to $5,555.50 of this sum, should certainly cover a high grade of professional ability on his part.

There will naturally arise a great deal of complication in a measure of the kind. Private owners have, it is claimed, expended thirteen millions of dollars in reclamation works, and, as much of the land is considered secure, such owners will not be likely to favor a bill that taxes them in the interest of lands outside their districts and works. We note that Sherman Island is to be excluded in the proposed district, no doubt for the reasons just mentioned.

This private work has been mainly on islands or lands surrounded by the river and sloughs. They contain a large share of the areas contemplated in the drainage scheme, and the best of it.

The principal islands and their areas are as follows:

Sherman Island	14,000	acres.
Brannan Island	7,000	"
Andrus Island	7,600	"
Grand Island	17,000	"
Bouldin Island	6,400	"
Bacon and Mandeville Island	13,200	"
Roberts Island	60,000	"
Rough and Ready Island	1,630	"

The four last named are in the San Joaquin Valley, and the total of the whole is 126,830 acres, or about an eighth of the whole area affected, and no doubt a fourth of cultivatable lands included in the proposed drainage scheme.

The plans here presented by Messrs. Manson and Grunsky, apply only to the Sacramento Valley, and a further survey will be required to include the San Joaquin district. The Commissioner, Mr. A. H. Rose, recommends that an appropriation of $50,000 be made for that purpose.

The Linde Ice Machinery Company has fitted up one of the Leyland Line steamers, between Boston and London, to carry fresh meat. The storage space holds 1,600 quarters, and is fitted with brine pipes that maintain a nearly constant temperature from 28 to 29½ degrees, or not to exceed a variation of 1½ degrees. Hitherto this trade has gone to Liverpool, and caused a good deal of expense in re-shipping to London. The new refrigerating apparatus is spoken very highly of.

LITERATURE.

Report of the Chief Constructor U. S. Navy, 1894.

Chief Constructor Hichborn submits the usual report of naval construction and repair for 1894, ending June 30th, also various suggestions in respect to the naval stations, among other things some changes and additions at Mare Island, where there is but one dock, continually in use and barred by shoal water except at high tide. The subject of an experimental tank is again brought forward, and an appropriation of $100,000 for that purpose is recommended.

Eighteen war vessels of all classes were under construction in July last. There were launched during the year, the *Oregon*, *Minneapolis* and *Ericsson*.

Chief Constructor Hichborn omits, as he did last year, any mention of means to prevent fouling iron and steel vessels, a subject that he is said to have given a good deal of attention to, and certainly deserving all consideration that can be bestowed upon it.

Scientific Lectures.

The Open Court Publishing Company, of Chicago, have reproduced in a neat volume of 300 pages, twelve of the most interesting lectures of Dr. Ernest Mach, Professor of Physics in the University of Prague, Germany, translated by Mr. T. J. McCormack.

The lectures included are: (1) The Forms of Liquids; (2) The Fibers of Corti; (3) On the Causes of Harmony; (4) On the Velocity of Light; (5) Why has Man Two Eyes; (6) On Symmetry; (7) On the Fundamental Concepts of Static Electricity; (8) On the Principle of the Conservation of Energy; (9) On the Economical Nature of Physical Inquiry; (10) On Transformation and Adaptation in Scientific Thought; (11) On the Principle of Comparison in Physics; (12) On the Relative Educational Value of the Classics and the Mathematico-Physical Sciences.

Of all those who have soared in the realm of abstract thought Dr. Mach is, perhaps, the most original. At first there seems a tinge of eccentricity in his strange and unexpected deductions, which after a time becomes originality, and in the end plain reasoning. It is in many ways typical of modern German thought, if classification of the kind is possible.

It was venturesome translation to turn these lectures into English, and there is, no doubt, a loss in their separation from the idiom in which they were framed, but the work is well done, of that there is no doubt.

The subject matter, by numerous references and allusions, indicates the erudition of the learned lecturer, but such allusions and references are not left obscure, but are always made plain by the context.

The longest lecture, and perhaps the one of most interest, is that on teaching the classics and sciences. The conclusions are incontrovertible.

For those who "think," there is here a treat, compendious beyond conception, and the essence of what would not very long ago have constituted a library, and not a small one.

Notes on the Year's Naval Progress to July 1894.

U. S. OFFICER OF NAVAL INTELLIGENCE, WASHINGTON, F. SINGER, CHIEF INTELLIGENCE OFFICER.

The Intelligence Bureau of the United States Navy is intended to supply the department, and to some extent the public, with information of all kinds bearing upon progress, invention and discovery in the arts that go to make up a navy, also in naval science and administration. As may be supposed, a good deal of the matter prepared has interest outside the department, in steam engineering for example, of which more will be said farther on.

One of the most striking features in the present document are graphic forms showing methods of naval administration in six European countries, and the almost absence therein of the department of machinery and motive power. This becomes the more strange when we find in the present Report one hundred pages, out of four hundred and

fifty, or nearly a quarter of the whole, counting connected subjects, devoted to motive power and machinery. Evidently it has not been discovered yet that among the main elements of a modern war vessel, and in a sense the first one, is the machinery for propulsion, lighting, handling and general functions in warfare. It is curious, when we consider it, how slow other things move when compared to science and discovery. Sometime, not long hence, the departments of administration will be differently arranged.

The technical topics discussed in the present Report are as follows: Notes on Ships and Torpedo Boats; Notes on Ordnance; Notes on Small Arms; Notes on Naval Dynamo Machinery; Marine Boilers; Conclusions and Recommendations of the Committee Appointed to Consider Existing Types and Designs of Propelling Machinery and Boilers in H. M. Ships; The Qualities and Performances of Recent First-Class Battle Ships; Some Naval Manœuvres in 1893.

Following these chapters is a complete history of the recent revolt in Brazil, written by Lieut. C. C. Rogers, U. S. N., covering forty pages, which constitutes the most complete account of the circumstances connected with this war we have in our language, or are likely to have. Lieut. Rogers was an eye witness to the principal events, and has written his account in a clear and connected manner throughout. Two fine maps accompany this report, one of the country of Brazil, and one of the bay and harbor of Rio Janeiro, where the principal operations of Admiral de Mello were carried on.

Chapters, or sections, VI and VII, occupying 58 pages of text, with forty-one drawings, mostly plates, are devoted to marine boilers, and is perhaps the best treatise on the subject that can be referred to. It is the work of Past Assistant Engineer Robert S. Griffin, who has evidently, in a sense, exhausted the subject.

His report includes "The Conclusions and Recommendations of a Committee Appointed by the Lord Commissioners of the Admirality of Great Britain to Consider Existing Types and Designs of Propelling Machinery and Boilers in Her Majesty's Ships." This report is confined to shell or cylindrical boilers, while a large part of Engineer Griffin's contribution is devoted to various kinds of water-tube boilers, chiefly to modifications, which is a distinguishing feature of these, and are endless.

Manual of the Marine Engineers' Beneficial Association.

SAN FRANCISCO.

This extensive organization, No. 35, embraces a large and useful body in the commonwealth, one that by the nature of their calling, and its responsibility, has an intelligent membership.

They print every year a manual, or annual, containing a list of the members, with the address of each, and a collection of judiciously selected technical matter of interest and use to engineers and others.

This Society was organized thirteen years ago, meets every Tuesday evening in the Alcazar Building, and has a library and reading room at 9 Mission Street, in this City.

A commendable and fitting addition to the present issue of the manual are fourteen photoplates of war and other steamers built on this Coast, constituting alone a valuable souvenier.

We have handled both the shovel and the throttle, and have a feeling of interest in an association so well managed, and with objects so commendable.

Final Report of the California World's Fair Commission.

BY J. C. JUDKINS, LATE SECRETARY TO THE COMMISSION.

The present report is an orderly arrangement and compilation of statistical and other matters connected with the work of the Commission and the California exhibits at the World's Fair of 1893. It includes accounts of receipts and disbursements, with lists of all kinds, and photoplates, with descriptions, of many of the principal exhibits,

It will be remembered that California, except Illinois, voted the largest sum of any State in the Union to be applied to this purpose, and there is no doubt that, considering the complexity of the matter, and the distance from the place of exhibition, and the segregated points from where exhibits were drawn, the Commission has done their work very well, and have returned

$20,000 of the original fund of $300,000 appropriated.

That the exhibit was creditable, and more, we have evidence in the reports of the time, and it might have been more so if it were not that there is no object, and sometimes the reverse, in exhibiting in the Eastern States the products of skilled industry on this Coast. This is indicated in the paucity of such exhibits in the list. They are nearly absent in so far as machinery, but this latter being mainly made to order, and for special adaptation, is not to be wondered at, besides most of the work made here is ponderous and not suited for sending to an exhibition.

The Union Iron Works, for example, asked their manager to furnish an estimate for showing a marine engine at Chicago. The sum was $40,000. This company made for an exhibit a model of their works that cost $14,000, and sent that, which was, no doubt, the best thing that could have been done. This model we see listed in the "transportation" class.

There is no use, however, in recounting, or reproducing, from the present report facts that are old, and now known to all interested. The display was all and more than was expected, and its history here is complete.

Proceedings of the International Electric Congress.

HELD IN CHICAGO, AUGUST, 1893.

We are favored with a copy of these proceedings through Mr. R. W. Pope, Secretary of the International Congress, and now Secretary of the American Society of Electrical Engineers, an unlooked for courtesy, fully appreciated.

In this Congress, at Chicago, was assembled some of the foremost electricians of the world, from all countries where electric science has extended. The papers presented and the proceedings of the various sections, are by far too extensive a list to be presented here. They cover nearly the whole field of modern discovery in electricity, and must have been a potent factor in bringing about an international intercourse, interest and feeling.

Dr. Elisha Gray, of Chicago, to whose suggestion, and largely to whose efforts, the scheme and consummation of such a Congress took form, was elected permanent chairman. Dr. Herrmann von Helmholz, of Berlin, being honorary President. Vice-Presidents were selected from this country, France, Italy, Switzerland, Mexico, Great Britain, Austria, Sweden and British North America. A photoplate of the official delegates is included in the report, happily taken so as to show complete portraits of most of the members.

Of course a publication of this kind does not admit of review, or even opinon, except to say that it is invaluable to those engaged in electrical pursuits.

Of the sixty or more papers presented to this Congress there is not one that does not include original research, and constitute a contribution.

The discussion which followed the paper of D. C. Scott, of Pittsburgh, on the Tesla polyphase system, is among the most interesting chapters of the proceedings; also the discussion on the fourth day, of Dr. Pollak's paper, when Prof. Forbes spoke at length upon the transmission proposed at Niagara Falls.

Here and there someone who wanted prominence would thrust themselves forward and "talk," but on the whole the present work of 500 pages is an exponent of "where we are at" in electrical science.

The Cyanide Process of Gold Extraction.

[Bulletin of the California State Mining Bureau, 1894.]

BY DR. A. SCHEIDEL, E. M.

A misfortune in all new industries and processes is that they do not admit of exhaustive treatment until the necessity of such treatment has passed away.

Had Dr. Scheidel written the present essay in 1890 instead of 1894, it would have been of incalculable value to the mining interest, not so much in respect to its technical value as in determining the commercial phases of the cyanide system. The problem that comes up on nearly every case is this: Is the ore suited for cyanide treatment, and will it be profitable to adopt it; also what patents exist, and what are their scope? These things are all answered in the present bulletin, also a history of the method, drawings of examples, in short it is the whole subject. This bulletin (No. 5) will no doubt have a wide circulation.

Local Notes.

The people of Portland, Oregon, having become tired of paying about five times a fair rate for water pumped from the Willamette River into the town, have arranged for a supply to be brought from a stream with the euphonious name of "Bull Run," the latter word meaning, as we understand it, a brook or river. To convey the water, a pipe from 33 to 42 inches diameter, 24 miles long, is required. This pipe is to be made of steel, will weigh 7,000 tons, and cost $460,000. It will be made in Portland by a local firm, who in addition are to make 7½ miles of distributing pipe, 18 to 20 inches diameter, the whole making up a very large contract. The same firm, Wolff & Zwicker, made last year $70,000 worth of pipes for the Spokane water works, and have, it is said, some excellent facilities for such work.

We were very interested recently in looking over the boiler-making plant in the Risdon Iron Works, in this City. It is a fair illustration of the ingenious methods sometimes adopted here to meet the varying requirements of work. The plant has been increased by a number of heavy standard machine tools of the best class for boiler work and the manufacture of Galloway tubes, but the most striking part was a boiler-drilling machine for shells, that embodied all the functions of the most elaborate implements in use in the Eastern States or in Europe, at about one fourth the cost. These functions included a train of drills, adjustable in all planes, hydraulic turning devices for the shells, with a speed and completeness of performance limited only by the cutting capacity of the drills themselves. Overhead traveling cranes spanned the floors, and on all sides were to be seen ingenious and efficient expedients for the work.

Tacoma, Washington, is just now experiencing some of the results of negotiating with corporations. In a kind of swindling deal consummated by the purchased universal suffrage system, the taxpayers have been mulcted of about a million dollars by a water works deal, a land company and a bank. The story is a long one, not worth while relating, because it is an old one in kind. A resident, writing to the *United States Investor*, says that in order to get

certain men into official positions, so as to defraud the City, there was wholesale "bribing the labor vote." Tacoma is the promising city on the Sound, and this lesson to the honest portion of the community there should not be lost. Hereafter they will keep a watch on "white shirt rascals," as some one has called the monopolistic element. In the above-named transaction Tacoma acquired a water works, but very little water, and now must arrange for some new method of supply.

Since writing the above we have come across the following in a reputable Eastern journal, which will explain the difficulty at Tacoma:

"A suit to invalidate $2,150,000 of Tacoma, Washington, water works bonds, recently sold in the East, was filed on the 24th ult. The suit is directed against C. B. Wright, of Philadelphia, who accepted these bonds in payment for the Tacoma water works. The suit is brought by a judge of the Supreme Court, who appears as a taxpayer, and sets forth that the original sale of the water plant to the city, consisting of 'rotten wooden flumes, and other materials, a few bits of land, and the Maplewood Springs,' and worth only $500,000, was consummated through fraud, corruption and bribery, that the quantity of water promised is lacking by half, and that Wright cannot divert what there is. Therefore the bonds are alleged void on their face, and the payment of $50,000 interest semi-annually on the same through a New York bank is asked to be perpetually enjoined."

The rainstorm that began last year on the 25th of November, and continued with little intermission until January 22nd, about fifty days, has not been exceeded in the annals of this Coast. The "old timer" can tell of heavier storms, and there have been many of them, but the precipitation, if ascertainable, is, no doubt, a maximum. Just how much it has rained no one knows; places twelve miles apart have a record as two to one. On the eastern side of Mount Tamalpais, ten miles from San Francisco, fifty inches of water fell. In the City half as much. Wherever there is an elevation along the Coast there is a flood of precipitation to leeward. The rain falls in spots, so to speak, but has, in a wonderful degree, soaked into the earth, assuring one, if not two years moisture.

Why does "Industry" lean to pessimism, and devote attention to faults instead of merits? asks a patron. The answer is that our

ROCK DRILLS

FOR MINERS

QUARRYMEN AND CONTRACTORS' WORK

Operated by either Compressed Air or Steam. Designed Especially for Efficiency, Durability and Capacity.

THE NEWEST AND BEST IN THE MARKET

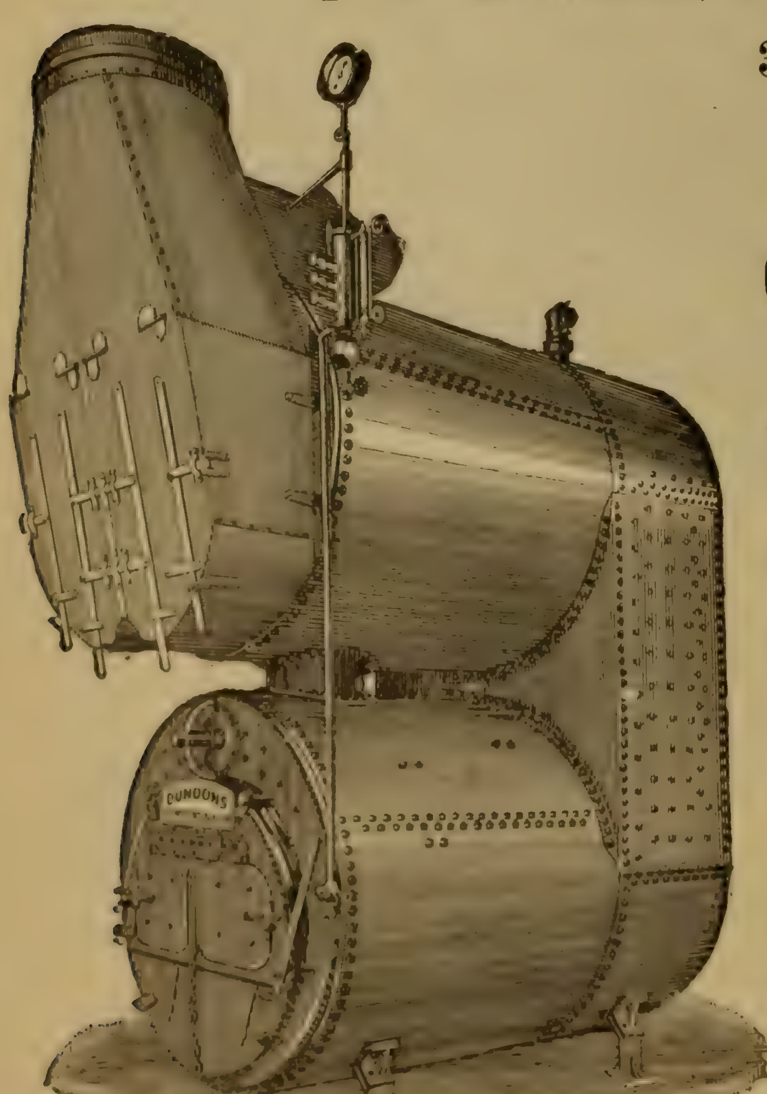
ABNER DOBLE COMPANY

Strictly High-Class Work.

DUNDON'S

SAN FRANCISCO IRON WORKS

P. F. DUNDON, Proprietor.



314-318 Main St., S. F.

DUNDON PATENT

COMPOUND BOILER

Approved for Marine Use.

Has produced 35 per cent. fuel economy over water-tube boilers in stationary use.

Steam boilers of every description designed and constructed.

Plate and Sheet-Iron Work

IN ALL FORMS.

GENERAL REPAIR WORK

PROMPTLY AND REASONABLY EXECUTED.

DUNDON PATENT

ECONOMIC BOILER

A SPECIALTY.

contemporaries do the other part. Satisfaction hinders progress, and the true reformer is a grumbler. No one works without an object, and emulation is the main incentive in industrial progress. "INDUSTRY" is not opulent, but independent enough to seek out the truth as near as it can be ascertained. Technical matters do not deal with fancies, tastes or emotions, but with facts alone, furthermore have nothing to do with localities, countries, or races of people. It would be pleasant, and perhaps profitable, to tell everyone that they had excelled, were wiser, and more advanced than their competitors. It has been the method of the Chinese, and is not succeeding very well just now.

Mr. P. F. Dundon, of this City, late a City Supervisor, and proprietor of Dundon's San Francisco Iron Works, was appointed chairman of the Committee on State Inspection Laws, at the New York convention of the American Boiler Makers' Association, in 1890, to draught and report at the St. Louis convention in 1891, a bill to regulate State inspection. Mr. Dundon has formulated in fifteen articles a Bill governing the inspection of boilers, which he urges as a proper basis for legislation. Copies of this can be had from the author, at 314 Main street, in this City. We do not propose to comment on this proposed Bill, but will say that some means are required to stop the fearful loss of life and property from boiler explosions. Destructive explosions reach in this country thirty to forty per month, against one fifteenth as many in Germany, in proportion to the steam power in the two countries. In the reports of the Hartford Boiler Inspection and Insurance Co., there is listed monthly from 700 to 1,000 dangerous boilers. Mr. Dundon's appointment on the committee before named was quite a compliment to him and to the steam boiler interest in this City.

It is time for the Government inspectors to rise and explain how a steamer like the lost *Kewenaw* was permitted to sail out of this port if the reports of her condition are true, or half true. She was sent around here, no doubt, because regarded as unsafe in the Atlantic, and put into the coast coal-carrying trade, where if anything happened death to all on board was an inevitable consequence. An Eastern journal claims the vessel was unseaworthy in many ways, the hull built with light scantlings, the stern framing broken, the engine frames broken and patched, with other weak features

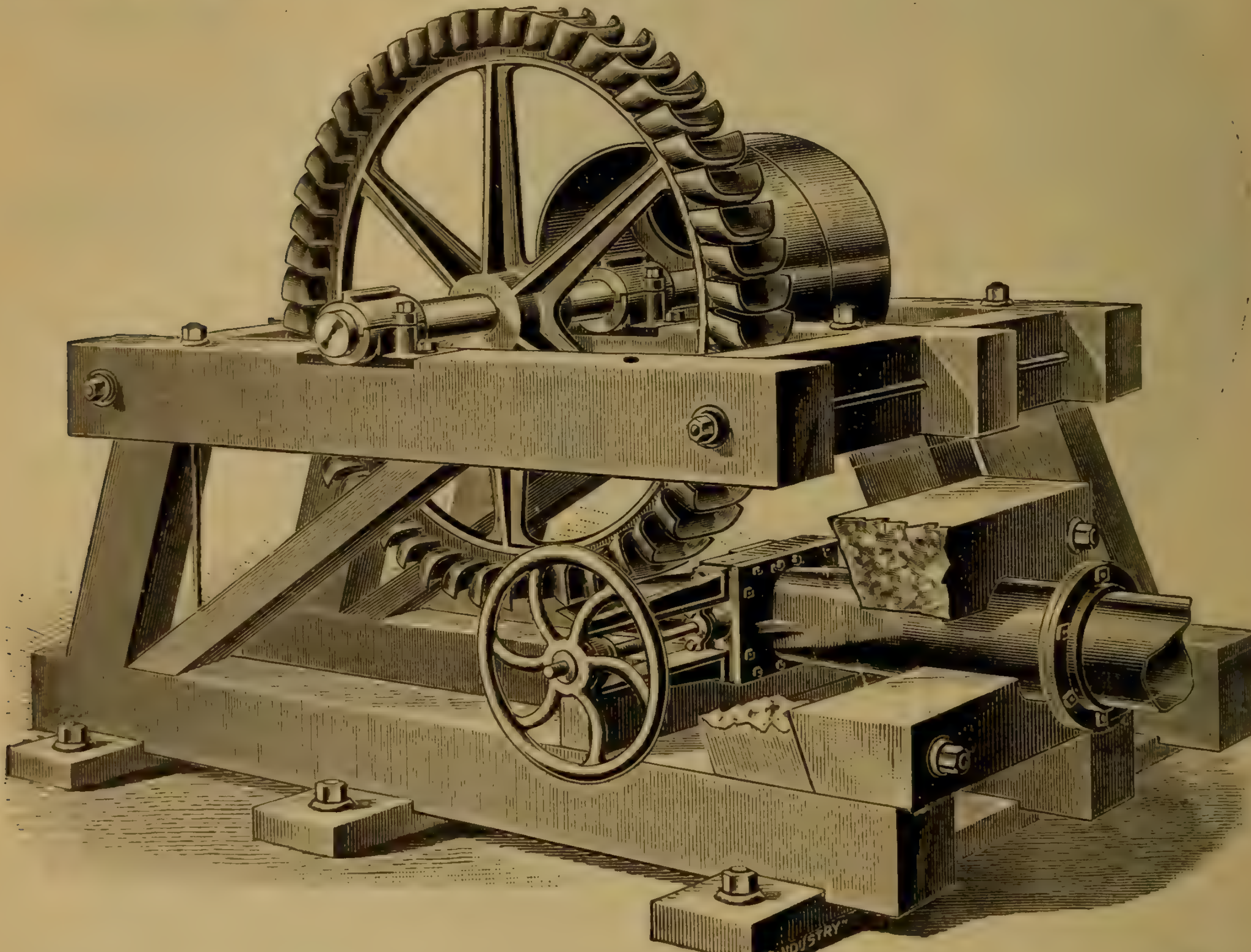
that should have at once condemned the vessel for open-sea service. Now the question comes, who is responsible and what will be done about it? If our merchant marine is to be harassed, inspected and taxed double, what is it all for?

One of the best examples of good honest machine work we have seen in a long time were some sugar-cane mills at the Risdon Iron Works, in this City, examined during a visit there last month. It may be said that a sugar mill is not the kind of machinery to display good work, and is not in one sense, because of the lack of finish, but there is something else about work of any kind that betrays its quality and class. The old-time sugar machinery, such as was made in the Ohio Valley for the Louisiana district, was rough enough, and lacked proportions, but in late years machine firms, especially those about Glasgow, in Scotland, where a great deal of this machinery is made, have brought it up to a high degree of symmetry and proportions. The example above named accords with the most advanced practice anywhere.

Locomotive Engineering comes this year in a new dress, and improved in many ways "constructively," otherwise it did not need improvement. The present size, 9 × 12 inches, will admit all kinds of plates, is easier to handle in number and infinitely more so when bound. The machinery of railways is a wide field, strictly adhered to by *Locomotive Engineering*, which is written in a candid and able manner by men skilled in their calling and profession. Railways are to a great extent a problem of machinery, just at this time of the year especially, when snow-clearing devices are at work over the whole northern end of this country. In the present February number there is a good deal of space given to dealing with snow and ice, which sounds queer to people hereabouts, who are setting out plants and gardening.

Passing the Keystone Boiler Works, of Messrs. Hamilton & Leach, recently, we were much pleased to see various kinds of internally-fired boilers in process of manufacture. It is a healthy sign, conservative, one may say, and means that some purchasers at least are to be happy in owning safe and economical boilers that will not disturb their expense account for many years at a time. A

THE KNIGHT WATER WHEEL



The drawing above shows one of Knight's Standard Water Wheels, of which there are more than 350 in use in California alone. These wheels are made from 2 feet to 6 feet in diameter, from 10 to 1000 horse power, and adapted to all heads and to all purposes. Their first cost is less than one half as much as pressure turbines, and the expense of maintenance is not one fourth as much. Circulars with full description and particulars sent free.

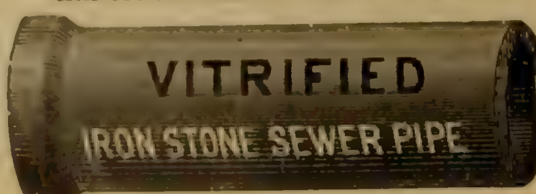
KNIGHT & CO.

SUTTER CREEK, Amador County, Calif.

N. CLARK & SONS

MANUFACTURERS OF AND DEALERS IN

CAPS AND TOPS



FIRE BRICK AND FIRE CLAY

Water Pipe **Chimney Pipe**

17-19 SPEAR ST., SAN FRANCISCO

Lancashire or Cornish boiler costs more to begin with, but pays the investment back in good time. We once took an American friend to look at one in a flour mill in England, where a compound condensing engine was driving two pairs of four feet burrs, and on looking into the furnaces he remarked: "Why the fire is out." "Yes," said the attendant, "I have been busy about other things this morning, but I will make up the fire before long."

The Dow Steam Pump Works, of this City, have issued a neat and complete catalogue of the various hydraulic machinery made in these works. The form, arrangement, type and make-up, are faultless for a publication of the kind, while the photo-plates and engravings, of which there are about forty, have not been excelled in any trade publication in this country. The Dow Steam Pump Works, which have been quite busy through the whole of the dull times, furnish a good example of sticking to one line of business, and profiting by the system and division of labor that standardized work permits. Some of the latest designs from these works have recently been illustrated in "INDUSTRY," and some others will be noticed in future. A new catalogue indicates progress, and we hope to see more of them this season.

The celebrated Snoqualmie Falls, near Seattle, Washington, are about to be the subject of a great scheme. The possible power afforded is estimated at 50,000 horse power, which a recently organized company proposes to utilize and convey by electric lines to Seattle. The capital is to be 20,000 shares of $100 each, or $2,000,000, and a bond issued, or to use plain terms, money borrowed to the amount of $650,000. The authorized issue is $1,000,000. The company's securities or property will be the falls and 350 acres of land, of which no value is given, but will no doubt absorb a large number of the shares. The circumstances are very favorable for a power plant, and it is hard to see what so much money is wanted for, unless in transmission apparatus.

The Parrott Estate, now erecting a fine building in this City, it is reported, have contracted for elevators to the amount of $80,000 with an Eastern firm. This is a most extraordinary matter, when we consider that in no other city in this country, and perhaps

nowhere else in the world, has there been a more complete development of elevators. The first electrically-operated ones were made here, and in no branch of the art is there necessity for contracting in the East for work of this kind. The Palace Hotel plant, constructed eighteen years ago, has always remained a model one. The scheme at the Parrott buildings is, we are informed, to employ the Sprague method, which consists of a set of Armstrong multiplying pulleys impelled by a screw having a roller nut, and driven by an electric motor. We have criticised this gearing once before, and believe that whatever the ultimate method may be of connecting a motor, it will not involve ball bearings and a screw.

Electric Power comes for January in magazine form, made up in a manner that indicates extension and prosperity. It is in every way a creditable addition to monthly serials that have ventured upon magazine form, contains 96 pages of matter, with numerous plates, all relevant to that branch of science indicated in the title. Mr. N. A. Foster contributes an interesting account and description of the great plant at Niagara, and F. B. Crocker writes what may be called an analytical article on the theory of electro-metallurgy. "Conduit *versus* Trolley" is the title of an article by Mr. Joseph Sachs, that is extremely interesting in the historical facts given. "The Synopsis of Current Electrical Literature," by Mr. Osterberg, is continued.

COMMENTS.

When in 1893 officers of the United States Geological Survey attempted without success to obtain an endorsement of the Technical Society of the Pacific Coast for a scheme in which this State was to join in the work of preparing a geological map of the State, or a topographical map, as now remembered, we suspected some scheme of personal ends in the case, and said so at the time. The *Engineering and Mining Journal*, of Jan. 26, in speaking of this with other connected matter, says: "Neither do we know of any law authorizing the United States Survey to take appropriations from the States to do a portion of the State survey, and appropriate the whole of it; nor, as far as we are informed, do the statements rendered by the Geological Survey account for the large sums thus received by it." The United States Geological Survey was insti-

tuted in 1879 to deal with "public lands," and related to the national domain. The substitution of the words "United States" in an appropriation bill changed all, and since then the work has been moved about all over the country for objects that are not clear.

The re-appointment of Commodore Melville as Chief of the Bureau of Steam Engineering next summer may be considered a forgone conclusion. To his eminent ability can be added the commendable fact of his having no "hobbies," but a rational balance of original conservatism. Officers in his line of profession are not plenty, and when qualified in technical knowledge are almost sure to be wanting in administrative, or some other quality that pertains to the position. Without straining the point one may say that in no other country at this time is there a single officer that will rank with Commodore Melville in successful work. Such duties in most countries are diffused over a corps of officers. By duties we mean both work and responsibility, and chief among the causes of his success is a willingness to consult and observe the views of other engineers of reputation.

There is voluminous talk over the continual sinking of the gold reserve and the outflow of gold from the country, but the real cause is seldom reverted to, the cashing of American securities because of an apparent incapacity of Congress to deal with financial problems and the exposition of inflated stocks. It is settling day, and nothing will relieve the situation but a return to sound methods and confidence. Even in these stringent times the country is full of gigantic schemes, and bonds are in the air, so to speak. It is time to stop, and go to work earning instead of borrowing, and lopping off a load of useless expenditure born of the borrowing system. Every bond issued not covered by tangible property is money borrowed with insufficient security, and no one need wonder at "calling the loans," which is now going on.

In *Electric Power* for January we find the editor saying: "The true mathematician seldom displays pages of calculus and diagrams, but works out his solutions in private, after which he employs simple language in explaining his theory to outsiders, retaining his computations and equations for the few mathematicians who demand them." Nothing can be more true than this. The pedan-

try of mathematics is becoming tiresome. Computations are means to an end or result, an implement, so to speak, and to print pages of formulæ that no one, perhaps not even the author, could read without great labor is pure pedantry and display. The arrangement of simple quantities in algebraic forms to show their relation is correct enough, and about all that should enter into matter intended for general reading.

Germany has now three large shipbuilding companies or works. The largest is the Vulcan Works, at Stettin; next the Germania Company, at Kiel, and Blohm & Voss, at Hamburg. There are also the works of Schicau, at Elbing. Last year these yards turned out 68,200 tons of shipping, of which 8,100 tons were for the Government. The growth of the shipbuilding interest has been under a system which it is asserted would ruin the interest in this country, that is, no restriction of registry. Shipping is quite free in Germany, the mail subsidies paid being of recent date. Here is a country, insular in position, almost without sea coast, lacking fuel, timber, iron, and previous skill, going far ahead of this country in the development of a foreign shipping trade, simply because "let alone." The shipping firms of Hamburg fifteen years ago protested against Bismark's proposed "protection" to shipping, saying they would take care of that if the Government would let them alone.

Mr. Geo. Turner, whose father was a contractor on the Suez Canal, writes to *Engineering*, London, that when the work on the canal came near collapsing under the French engineers, a deputation came to Glasgow, and made a contract with a company of Scotchmen skilled in dredging, who prepared and took to Suez machinery and men to prosecute the work. About 500 workmen were taken out from Glasgow, also a staff of engineers, and when the work was got in hand, and success assured, de Lesseps secured a cancelment of the contracts with the Glasgow men, and had the machinery and plant turned over to French engineers, so that France should enjoy alone the honor of making the canal. Mr. Turner gives the names of four of these Scotch contractors, the name of the steamer that carried out the machinery, and the number and street of the office in which the workmen were hired. This communication is published in No. 1513 of *Engineering*, London.

CONTENTS.

Ever since that prince of journalists, Henry Labouchere, established *Truth*, and wrote its editorials in the first person, other conceited people have been thrusting their personality upon the public in titles, style of matter, and the personal pronoun "I" inserted in every sentence where possible. All matter addressed to an unknown reader should be written in the impersonal pronoun, unless it be when especial responsibility attaches to original views or opinions, but even this exception does not remove the egotism of the matter. Labouchere, of all men living, could come nearest to literary decency in writing "I." He founded the *World*, and then *Truth*, both journals personal and independent. His powers, antecedents and ability permitted it, but what of an obscure journalist who puts his name in a title and then proceeds to say what "I think?" A respect for public opinion, or, if not that, the opinions of all literary people of good standing, should deter a person from this course. There is, however, one satisfaction, the "I" comes up like the grass of the field to wither away in a season.

Mr. Cramp, of Philadelphia, has explained how a free ship bill would ruin American shipbuilding, because wages are much higher in this country. We have heard this story before. They heard it in England when the navigation acts were repealed, forty years ago. If wages are so much lower in England, why does not Mr. Cramp employ English workmen? There is no tariff on them, they are free to come, and only six days away. One might also ask why these British workmen do not of their own accord cross the Atlantic to get the higher wages paid here? It requires a high rate of duty to keep their products out of the country, so we are told, but they stay out themselves without a tariff. All such talk is meaningless, wages are nearly balanced when measured in the terms of production. As to material not costing more in this country, this may be true in respect to iron and steel, but nothing else. What Mr. Cramp fears is not so much free ships as competition, which would soon come, as it did in England, where the whole business doubled the first year under a free shipping act.

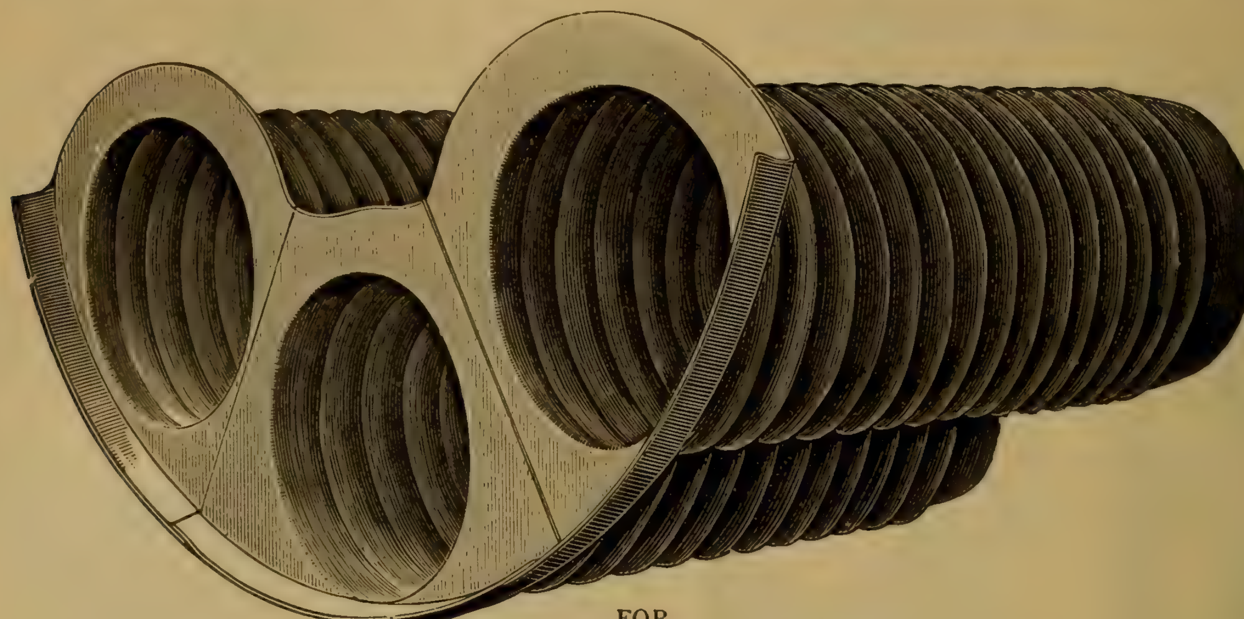
Engineering Notes.

Messrs. Russell & Co., at Massillon, Ohio, have arranged the various principal machine tools in their shops to be driven by compressed air, and are satisfied with it as a means of power distribution They employ pressure or piston engines, and one may well ask what would the result be if each machine was provided with an impulse wheel instead of a cumbrous engine. The motor would not be one half the size of an electric one, no heat, danger, or possible chance of derangement. Independent of impulse engines, air transmission has great possibilities, but there is yet a time to wait for impulse engines. The subject was treated at length in the last number of "Industry," somewhat in the line of prophecy, but the fact is within measurable distance.

From some experiments made in England it is a question whether "cup packing" should be made of leather or metal. It is very likely that it is a case of "running in a groove," the first packing of the kind being made of leather, all followed in the same way without question. It seems, however, that a packing depending upon stretching to compensate for wear, as is the case when disposed as a ring or collar, that steel or brass would lack this quality unless split, but the wear is very little in the case of metal. This metallic **U** packing was proposed by Mr. J. McDonald, of Tokio, Japan, two or three years ago, and has been applied to the piston rods of locomotives by several makers in England, and is said to have worked very satisfactorily. It is possible that when very thin a steel cup packing will yield enough for compensating wear, and if so it will avoid one difficulty in water packing, that of bad leather.

The most laughable expression that has turned up for a long time was in a recent letter of a correspondent to *Engineering*, London. The writer is evidently from "ayant the Tweed," and tells of a countryman calling an organ a "kist of whistles" (chest of whistles). It is a most laughable conceit, and was in a suggestion that the same genius would call a Belville boiler a "kist of pipes." "Jimmy" Howden is having a hard time in fighting these "kists

CORRUGATED FURNACES



FOR

MARINE and LAND BOILERS

Made in sizes from 28 in. to 60 in. diameter, with FLANGED OR PLAIN ENDS.

THE CONTINENTAL IRON WORKS

BROOKLYN, NEW YORK.

THOS. F. ROWLAND, President,
THOS. F. ROWLAND, Jr. Treasurer

WARREN E. HILL, } Vice-Presidents
CHAS. H. CORBETT, }

Take East 10th or 23d Street Ferries from New York to Greenpoint.

INCORPORATED 1866

CHARTER PERPETUAL

HARTFORD STEAM BOILER
HARTFORD
CONN.
INSPECTION AND INSURANCE CO.

Insures against Damage to Property, Loss of Life, and Personal Injury

CAUSED BY

STEAM BOILER EXPLOSIONS

J. B. PIERCE, Secretary

J. M. ALLEN, President

ABSTRACT OF STATEMENT
JAN. 1, 1894

Cash Capital,	$500,000.00
Total Assets,	1,862,501.25
Surplus as to Policy-Holders,	623,287.95

PACIFIC COAST DEPARTMENT

MANN & WILSON, General Agents

J. B. WARNER, Chief Inspector

306 Sansome Street, - San Francisco, Cal.

of pipes," and has with him at least a balance of sympathy. He proposes to race the Belville boiler, and concede the "kist of pipes" twenty per cent., and if he can do so, or anywhere near that, there will be no good reason for using the water-tube boilers at sea. A Scotchman is the most stubborn of mankind, when proceeding with his beliefs or convictions.

Mr. Barclay Parsons has been making an examination of urban railways in Europe, or in London, Paris, Glasgow and Liverpool, and has made a report to the Commission on Rrpid Transit, in New York City. He submits the following conclusions, which are much safer than they are comprehensive:

"1. That an underground railway operated by steam, even with the most approved system of mechanical ventilation, would be intolerable to the people of the City of New York.

2. That a railway with a steady frequent service, can be operated successfully and economically by electricity.

3. That an underground railway operated by electricity has a comfortable atmosphere, and that it can be arranged so as to avoid great changes in temperature.

4. The advice and experience of foreign engineers, lean toward keeping the rail level as close to the surface as possible, and that excavating from the surface is cheaper and safer than tunnelling, but

5. If conditions demand, a deep tunnel can be constructed, for which the circular form is best.

6. That an underground road can be so designed as to be attractive in appearance.

7. That the work can be carried on through a busy street, without endangering the houses, and without seriously impeding travel."

A correspondent of the *Mechanical World* writes to that journal to know why an air vessel should be placed on the suction side of a water pump. It is a simple matter, but is not commonly understood as other inquiries of the same kind indicate. The shortest and best answer is to say that an air vessel on a suction pipe is for precisely the same reason that such a vessel is put on the discharge pipe, to produce continuous flow. The analogy is complete, except that there is outward pressure in one case, and inward in the other case. There is also the difference that on the discharge side the pressure is positive up to the limits of the power of the pump, but on the suction side is limited to the pressure of the atmosphere, equal

to a head of thirty-three feet, but this is all the more reason for an air chamber. The main requirement for air vessels is, however, with long suction pipes, or as the weight of the water to be moved.

Mr. G. C. Henning, under the head of a "Paradox in Hydraulics," writes in the *American Machinist* of continuous-flow pumps, a subject presented last year by the Editor of "INDUSTRY" before the Technical Society of the Pacific Coast. Mr. Henning constructed a continuous flow pump, and found the discharge equal to more than double the theoretical displacement. He also analyzes the forces, and sets forth both graphically and by formulæ the particular conditions of such pumping, and for the higher speeds sets down a discharge of more than 90 per cent. over the displacement of the pump. Except a very few, no one seemed to understand the import of the paper above referred to. It is published in No. 60 of "INDUSTRY," and now seems likely to bear fruit. Some experiments are about to be made here by a well-known engineer that will, no doubt, confirm Mr. Henning's results.

It is beginning to be a problem how many forms water-tube steam boilers can be made in without departing from their essential features. There are not less than a hundred kinds of these boilers now made, and there is no limit to prevent every maker from having one of his own. There is no sign of a standard or constant type of any kind, and perhaps never will be. The very first we remember to have seen, the Clapp boiler, made about 1858, was theoretically one of the best. It had a series of pendant tubes projecting into the furnace, with a core tube of thin metal to conduct the water down in the center. The scheme seems to be nearly obsolete now, because of structural difficulties no doubt. The latest water-tube boiler, an Austrian invention, looks like a pin wheel in full motion. There is no vagarie of tubes, coiled, bent and straight, that cannot be found in these boilers.

There has been during two years past, a commendable effort toward rolling black plates for tin and terne in this country. This has undoubtedly been due in some degree to a pressure for work, but be the cause what it will, an industry once founded can be

safely left to the American ingenuity for the future. The same causes will act to widen other products, heretofore thought unprofitable, and there is this much to be credited to hard times. It is a drastic remedy or incentive, but produces permanent results, and is very different from a bonus or subsidy in good times, which by some obscure law not very explainable, causes an opposite effect. The law of manufactures is the survival of the energetic and the hopeful, of those who believe in their own powers and resources, and go out to face the world. Such people always succeed.

It is reported that at a cotton mill in Grosvenordale, Conn., the engines are compound, and consume but 12.45 pounds of steam per horse power hour, the maximum being 12.72 pounds. The cylinders are 18 inches, and 44.5 inches in diameter, 6 feet stroke. The proportion is six to one, and the expansion about 22 volumes. If this report is correct, it is a very remarkable example, and goes to prove that with compound engines so proportioned as to include the second cylinder, that can be dispensed with. This has been a contention on the part of a good many engineers, and has been argued on the basis of effect alone, but cutting out one cylinder with its cost, resistances and maintainance, is no small matter in favor of a compound arrangement. The above is the best record for steam economy that has appeared in mill practice.

Mr. Lewis Nixon, at the late meeting of the American Society of Naval Architects and Marine Engineers, read a paper on "Yachts in England and America," and denounced a lee, or centerboard as no proper part of a yacht. He says it is a mechanical device not properly a part of a yacht, disturbing the interior economy of the vessel, creating problems of design alien to the true art. This is unquestionably true. A centerboard may be a proper part of a small boat, or of any vessel for certain purposes, but not of a racing yacht. It is an extraneous attachment, the same as a buoyant outrigger, and a yacht thus equipped should not be matched against one not provided with the same rig. A center board weighing three tons, as the one in the *Vigilant* does, let down twelve feet or more below the keel, gives stability, but is awkward in handling, and in effect, as Mr. Nixon says, is like adding an electric motor and screw to aid the sail power.

Whether the detail power on war vessels is to be transmitted by water or electricity time will show, but one thing is certain, that steam will be abandoned. The heat, return pipes, and character of the motors, are all against steam. Water transmission by means of impulse wheels for rotary motion has many advantages, but is novel, and would have to pass through the usual course of evolution. For rectilinear movements it is now employed. If the same medium will perform both of these functions, as pointed out last year by Mr. Dickie at the Chicago Congress, it will certainly simplify matters. Electricity could be employed for rotary movements directly, but only by means of apparatus and gearing for rectilinear movements. Water is the only medium that will perform the two functions. Steam can, of course, be employed on pistons to produce right-line movements, but being elastic there would be no abutment or "lock," besides the heat would be an impediment. Water seems to be the most economical and direct means of operating fans, steering gear, capstans, winches, turrets, and so on.

Locomotive Engineering tells a funny story respecting the sale of an injector to a "scientific man" by a "machine chap" at Leadville. Using the vernacular, a "scientific man," who was superintendent of a mine, came to the shop in a stew over his feed pump for the boilers, and was persuaded to throw out the pump and replace it with an injector. The boss of the machine works went himself to see the $200 injector connected, and wisely too. He knew the service water at the mine was under a pressure of 105 pounds to an inch, while the boiler pressure was only 65 pounds, so he put a blind gasket in the steam pipe, and let the service water force its way through the injector into the boiler "without steam." He remarked on his way home that the scientific man would find it an economical implement, and there would be a "boom" in injectors.

One feature or fact in centrifugal pumping, that is overlooked or not known to many makers, is that water will not enter a pump when the impeller vanes sweep over the inlet way and are driven at high speed. To illustrate this, one cannot thrust a cane or lath through the spokes of a swiftly revolving wheel. European centrifugal pumps with their small impellers and consequent high speed of relation, are especially liable to this repelling action, and

very often are wholly inefficient from this cause. One maker who claims a high duty for his pumps, attaches a screw at the sides of the impeller to coax the water into the pump, and the idea is a good one if the difficulty is not otherwise provided for. In this way a pump can be made of smaller diameter for a given duty, but it is commonly inferior to a larger one for the same work.

Emile Geyelin, C. E., of Philadelphia, who designed the great Jonval, or the Geyelin-Jonval Water Wheels, as they are now called, for the Niagara Falls Paper Company, sends us a photographic elevation of the work, which certainly emulates if it does not excel the Fæsch & Picard plans of the greater plant. There are six wheels in the battery, so to call it, each of 1,100 horse power, or a total of 6,600 horse power. The head is 140 feet, and considering the slight change required in the Jonval system to convert it to impulse instead of pressure, we suspect that Mr. Geyelin has designed impulse wheels, and if so, we do not hesitate to pronounce his plans better than those of Fæsch and Picard, and with the least departure from what may be called established good practice, plain, symmetrical and straightforward, or as our English friends say without "fads."

In *Engineering*, for Dec. 28th, 1894, is a drawing and description of a triple trunk plunger pump and engine, made by a London firm, which if representative of British engineering in this line, need not cause any envy out here, because we much doubt if a machine so arranged would be accepted by a purchaser in San Francisco. The crank shaft is a bent one, three throw, held in two short bearings at the ends only, set up on a pair of angular ribbed trestles of cast iron that straddle the pumps. On the end of the shaft is a gear wheel, six to eight feet diameter, strong enough to twist off a shaft double the size. The engine is a horizontal stock one, backed up to the pump frame, and connected by an overlapping flange and some blocking. The "arrangement" as a whole, is crude, and the amount of iron in the framing of the pump part is appalling.

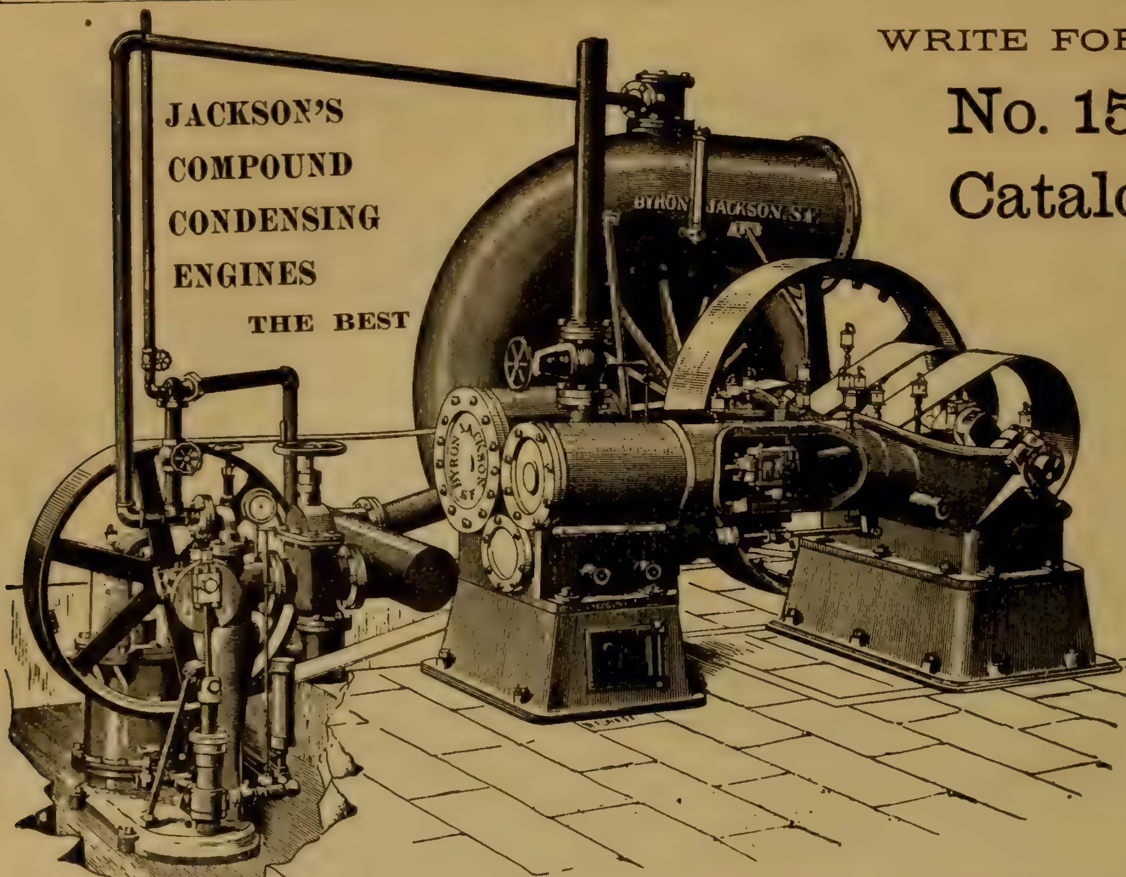
ELECTRICITY.

The General Electric Company are increasing their plant at Schenectady, N. Y., adding for one thing a storing house 353 feet long, 52 feet wide. A new laboratory is also in progress, to contain standard testing implements of an electric kind. The company have in view various improvements in their mining machinery department, and are fully employed, which for these times goes to show that whatever else is dull electrical matters keep in their even course. This vast business in all of its ramifications of branches, agencies, home and foreign, has been built up in a few years, and its administration calls for infinitely more skill than the civil government of a State, but it is not in the same plan. It is on just such a plan, however, as we need for civil administration.

The Pelzer Manufacturing Company, of Pelzer, S. C., has contracted with the General Electric Company, for a three-phase electric transmission plant, that will be exceptionally large and interesting. At the generating station, three miles from the cotton mills owned by the company, there will be three slow speed generators of 750 kilowatts, each directly coupled to water wheels. These dynamos will generate current at a potential of 3,300 volts, and the current will be fed directly to the transmission wires at this pressure. The transmission line will consist of eighteen No. 00 wires, this size having been selected in preference to larger wire to reduce the line induction as much as possible under the existing conditions. At one mill will be located a 400 horse power synchronous motor, receiving current directly from the wires. There will be in addition, more than twenty induction motors in various rooms. Of these, fourteen will be 110 horse power motor, and the others will be of various sizes, from 5 to 75 horse power. In a sub-station will be placed nine 160 kilowatt transformers for the motors and for 1,200 incandescent lights for the mills. Two electrically operated fan blowers of three horse power each will be used for cooling the transformers.

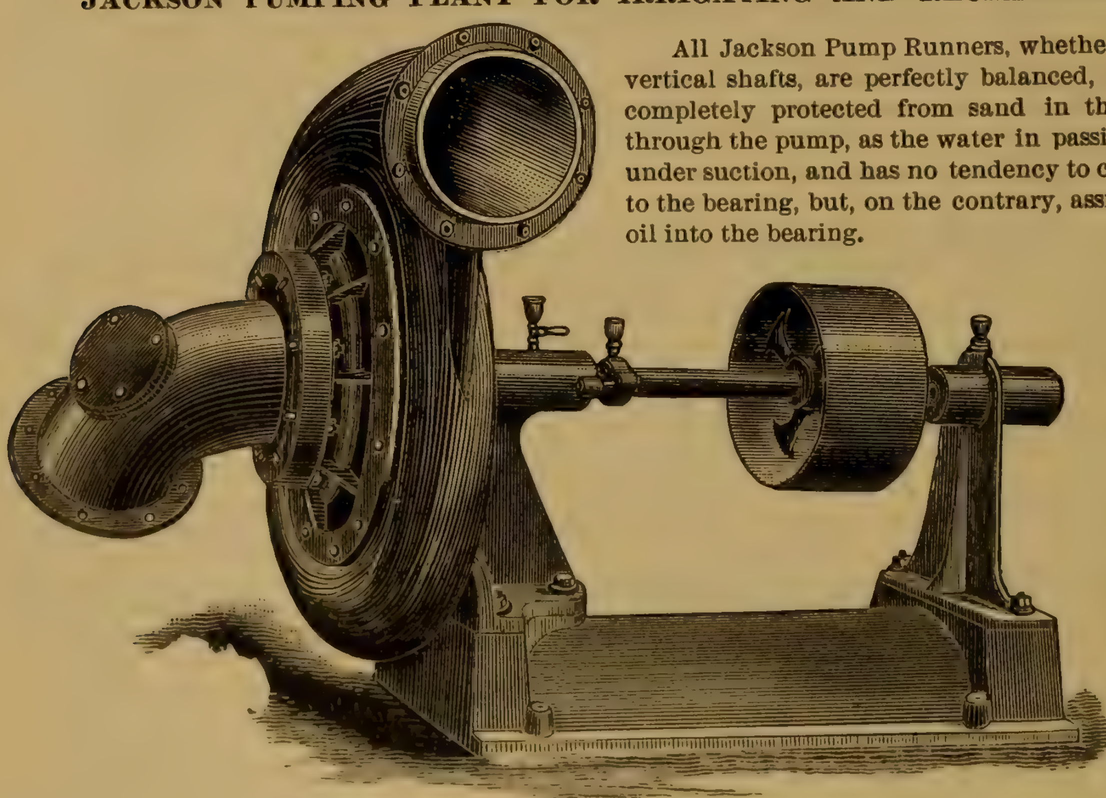
WRITE FOR

No. 15 Catalogue.



JACKSON PUMPING PLANT FOR IRRIGATING AND RECLAIMING LAND.

All Jackson Pump Runners, whether in horizontal or vertical shafts, are perfectly balanced, and the bearings completely protected from sand in the water passing through the pump, as the water in passing the bearing is under suction, and has no tendency to carry the sand into the bearing, but, on the contrary, assists in feeding the oil into the bearing.



JACKSON'S "WHIRLPOOL" CENTRIFUGAL PUMP
With cast sub-base, outboard bearing, and adjustable suction and discharge.

Byron Jackson Machine Works

—— BUILDERS OF ——

COMPOUND-CONDENSING ENGINES, AIR PUMPS

AND JET CONDENSERS.

Pumps for Irrigation and Reclamation, Dredging, Wrecking, Mining and City Water Works.

BOILERS AND ANY KIND OF MACHINERY BUILT TO ORDER.

625-631 SIXTH ST., SAN FRANCISCO, CAL.

MINING.

NOTES.

There is in process of arrangement a very interesting contest at the Bullion and Beck Mine, in Utah, between a Bryan crushing mill with Johnston concentrators, and a Huntington crushing mill with Frue concentrators. Such a trial, if impartially and carefully carried out, will be of a good deal of value as indicating not only the capacity attained by machinery of this class, but also the comparative merits of the methods in the two cases. The points to be taken into account are: (1) crushing capacity with a given amount of power and time, (2) the amount of slimes made, (3) the completeness and speed of concentration, (4) the endurance and maintenance of machinery. The wear of the crushing faces is also to be considered. Sampling is to be done every half hour, and the result made up in a report by judges in a careful manner. We hope to have in due course a copy of the report for publication.

Mr. W. P. Black, a mining engineer, claims that mines or deposits of Bauxite, the clay from which aluminium is extracted, exists on the Gila River, 40 miles beyond or above Silver City. It is singular that in the varied minerals of this country deposits of this kind have not been found. The Bauxite is a mass in place, as it is termed, and the alunogen, or sulphate of alumina, is an external or secondary formation caused by certain chemical reactions too intricate for popular understanding. The aluminium craze has nearly subsided, and the metal has assumed its place in the arts as far as its price permits, until some cheaper process of reduction is discovered, and this, considering the amount of experiment and research, is not quite a hopeful matter.

The overdoing of the borax business about eight years ago, when the great scheme was organized here, and caused disaster to certain worthy citizens in San Francisco, will long be remembered. About half a million dollars worth of borax is mined each year, and is all that is needed in the arts at the present time. The whole

amount now produced is about 4,000 tons, in California and Nevada only, and, as said, is worth about half a million of dollars annually. It is a curious subject of conjecture what the actual economical result or difference would be if the vast deposits in these States had not been discovered, and what the effect was, also the purpose of levying a duty of ten per cent. on borax as soon as the California deposits were discovered. It was like saying to consumers, now that there is an endless supply discovered the price must be increased.

The *Mining Industry*, Denver, announces an expedition of two hundred prospectors, who are to visit the Alaskan Islands next summer. Of these there are said to be more than two thousand, so there will be islands enough, ten to each prospector. A steamship is a part of the outfit, and it is on the whole a large and promising exploration, both in method and extent. Those interested, or wanting to join in this expedition are invited to communicate with the Alaska Steamship and Exploration Company, at Denver, Col. If such a venture was in the hands of novices, it would be an uncertain quantity, but the notice says the leaders will be men trained in the Alaskan country. The known existence of auriferous sands on a number of islands has, no doubt, led to this expedition.

The *Mining Industry*, Denver, has the following in respect to mining in Mexico:

"The number of mines now being worked in Mexico, according to recent records, is at least 3,000, with others worked only at intervals, and still others whose operations are hardly worthy of mention. If to these are added the large number of abandoned claims, many of which if re-opened would yield important returns, even greater in some cases than those now in course of development, the total would reach, according to our chief informant, 'incredible figures,' while new mines are being discovered day by day. The total amount invested in the silver mines of Mexico is roughly estimated at $800,000,000, of which not more than one eighth is American capital, while only an amount equal to one third of the latter, or $33,000,000, is British capital. The annual yield of Mexican silver and gold collectively is set down at about $40,000,000. The output of copper figures at about $2,500,000, and of coal at about $4,000,000. If we include iron, sulphur, marble, clay, mercury, salt, stone and metalloids, the estimated annual total of mining products would amount to not less than $65,000,000."

No. 81. APRIL, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.

WASHBURN & MOEN M'F'G. CO.

WORKS:

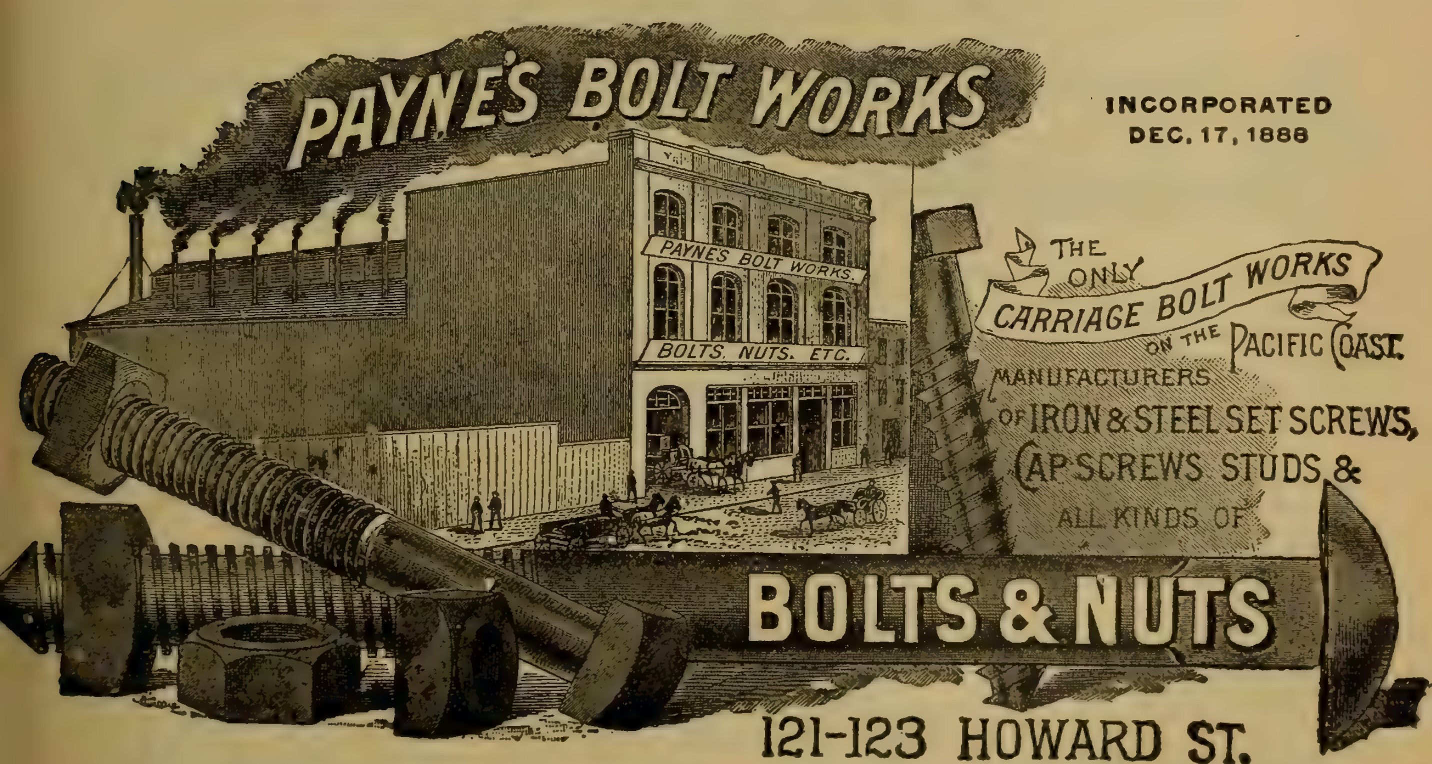
WORCESTER, MASS. WAUKEGAN, ILL.

BARBED WIRE.
BALE TIES.
WIRE ROPE.

IRON AND COPPER
BARE AND INSULATED
ELECTRICAL WIRES.
WIRE SPRINGS.

SAN FRANCISCO
OFFICE AND WAREHOUSE: **8 and 10 Pine Street.**

FRANK L. BROWN, Pacific Coast Agent.



Upset Bridge Rods, Truss Rods and Anchors, Turnbuckles, Head and Point Drift Bolts, Wine Cask Bolts with Brass Acorn Nuts, Cold Punched Square and Hexagon Nuts.

All Kinds of General and Special Blacksmithing

"INDUSTRY."

JOHN RICHARDS, EDITOR.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

SAN FRANCISCO.

FOUNDED 1888. APRIL, 1895. No. 81

EARLY HISTORY OF WOOD-WORKING MACHINES.

There is an excusable, or even a commendable, interest taken in the early history of all industries and arts. Our own country is too young to have participated in the earliest stages of many branches of skilled industry, but its history is none the less a matter of interest for that reason, and especially in respect to England, where the end of the 18th century was characterized by an activity in various inventions that has hardly been excelled in recent times, except in rapidity of evolution.

The Editor of "INDUSTRY," having at various times during eight years past been called upon to furnish facts in the history of wood-working machines, has concluded to publish in the present and some future numbers of the magazine, with revision, the introductory section of his work on the *Construction and Operation of Wood-Working Machines*, published in 1872, and out of print for a dozen years past.

It will be proper to remark that after the publication of the treatise in London, the various facts in respect to the inventions and work of General Sir Samuel Bentham in wood-converting machinery, then for the first time collected, were fully confirmed, and some added by his son, Hon. George Bentham. It is preferred, however, to adhere as closely as possible to the original text.

The writer regrets now, as he did when the treatise was published in 1872, his inability to include a history of wood-working machines in Holland, where for reasons that need not be explained it is believed there were a number of inventions and machines employed there that should be noticed in a history of the art. One reason for so thinking is the fact of records recently made public in respect to other branches of industry, compound steam engines for example, that indicate for the Netherlands a foremost place in the mechanic arts during the 17th century.

The present history comes down to but does not include the remarkable history of wood-working machines in this country since 1840. An attempt to compile such an account failed because of the time and labor required.

"It is not assumed to give all the facts connected with the origin of machines for cutting wood; it would be impossible to gather them except at an expense and trouble that there is nothing to justify. It is, however, safe to assume that, unless in some part anticipated by inventions in the Netherlands, the history here given as to the origin of machines for planing, boring, sawing, and so on, is substantially correct.

With nearly all of the constructive arts we can trace their history back to a time when they were founded by the persevering efforts of a single person, some bold spirit, whose conceptions carried him beyond his age to meet and combat the skepticisms, if not the jeers and mockery, of those around him.

The application of steam as a motive power came down to us through a number of inventors, each adding something left out by his predecessors, until the invention culminated in the labors of Watt and Trevithick. The first conceptions were crude, and gave no useful results beyond stimulating others to further efforts. A similar history attaches to engineering tools for cutting and shaping metals, and while the original idea of the use of power in such operations could no doubt, as said, be traced to a kind of fatherhood in some one person, no new art seems to have been so fully developed, or so nearly perfected, at one time and by one man as that of wood-cutting machines by General Bentham.

In attempting to search into the history and origin of these machines there can perhaps be no more appropriate introduction than a brief personal notice of this remarkable inventor. We say remarkable, for when one considers the crude mechanical manipulation of his time and the paucity of resources that then existed, it seems impossible to find anything to suggest, or even a want to justify his labors.

As Bentham's inventions constitute nearly all that was known of wood-cutting machines in the Eighteenth century, their history at

that period cannot be much else than an account of his earliest labors and inventions, which, we are sorry to say, comes down to us only through his patents and scraps of history gathered from the records of the English dockyards, where his machines were first applied to public use. His later machines and inventions have a more extended history, as will appear further on.

Brigadier-General Samuel Bentham, Inspector-General of the naval works of England, received a thorough classical and, it is presumed, scientific education, at the Westminster School, London, which no doubt ranked high as an institution of learning at that time (1770).* After completing his education his predilection for naval affairs led to his being bound to the master shipwright of Woolwich Dockyard, where he served the regular apprenticeship of seven years, becoming familiar with all kinds of practical manipulation in wood and metal, and receiving the best scientific instruction that could then be obtained. After completing the term of his apprenticeship at Woolwich he spent eighteen months in visiting other dockyards, to familiarize himself with any local peculiarities of their tools and work not known at Woolwich.

In 1779 Bentham was directed by the government to make a tour in the north of Europe to examine the progress of shipbuilding and other arts. During this tour, while in Russia, he invented the first *planing machine* for wood, at least the first that could be called an organized operating machine. There is no doubt but that this was the original conception of a machine for smoothing the surface and giving dimensions to wood. We have ignored the machine of Hatton, patented in England in 1776, for the reason that it seems to have been an inoperative one, if it can be dignified by the name of machine at all. It appears to have been merely an idea for guiding planing cutters by means other than the surface of the wood.

Taking the drawing as an exponent of the invention it has not been thought just to consider it as anticipating the invention of Bentham, who, if we are to judge by his other machines, would never have considered this as an operating machine for the purposes indicated. It is to be regretted that no accurate description of Bentham's invention has been preserved. Whether it operated by what in his subsequent patents he terms "rotative" motion, or whether it was a reciprocating machine, is, so far as the author can learn, left to conjecture. It would, however, be inferred from his first patent in England, of 1791, that it worked upon the latter principle, for 'planing and making mouldings' by means that bore a close analogy to the hand operations of the times, and corresponds to the one described in the patent referred to. Bentham, with that regard for his country's interest that is common with all Englishmen, communicated his invention to the British Ambassador

*In a communication from George Bentham, Esq., written in 1872, he says: The facility my father had in clearly describing machinery without the aid of illustration was probably derived from the practice he had acquired of drawing up the whole of the propositions of Euclid without reference to figures, as he had on the other hand represented them by figures and signs.

at St. Petersburg, who advised him to keep his invention for England, which seems to have been done, as there is no account of his having made any public use of it while in Russia.

He afterwards accepted a military commission in Russia, with the rank of lieutenant-colonel, and became the manager, or commandant, of extensive factories for the production of glass, metals, cordage, works in wood, and so on. His very successful management of these works would from accounts lead us to suppose that he invented many new and useful machines, but of these there seems to be no record in England.

He returned to England in 1791, about which time his brother, Jeremy Bentham, the celebrated jurist and writer on political economy, received from the government an appointment to introduce industrial prisons in England. This kind of labor being almost devoid of skill, the talents of his brother were called into use to devise machines that would make the labor more profitable, and at the same time supply to some extent the want of skill in the convicts. To construct these machines, most of which were for working wood, the residence of Jeremy Bentham, at Queen's Square Place, Westminster, nearly in the heart of London, was, with its capacious outhouses, converted into the *first manufactory* of wood-cutting machines. One hundred and four years ago this factory was established, and, as we are informed, was not found to be sufficiently large, so that a building, No. 19, York Street, was also occupied, which would lead us to suppose that a great many machines were made, and that the extent of the business fully entitles it to the distinction of being called the first general factory of such.

Professor Willis, in a lecture before the Society of Arts in 1852, states that 'there were constructed machines for all general operations in woodwork, including planing, moulding, rebating, grooving, mortising and sawing, both in coarse and fine work, in curved, winding and transverse directions, shaping wood in complicated forms, and that further, as an example, that all parts of a highly finished window sash were prepared, also all the parts of an ornamental carriage wheel were made, so that *nothing remained to be done by hand but to put the component parts together.*' These machines were examined by members of His Majesty's administration, and received official notice and commendation in the House of Commons in 1794, and Bentham (Sir Samuel) was commissioned to visit different dockyards, and to determine how far his machines could be applied to facilitate shipbuilding. At the same time he refused a flattering offer from the Emperor of Russia in order to accept this commission, choosing rather to give his country the benefit of his services than to reap a greater pecuniary reward that awaited him in the northern empire.

His report was, no doubt, very favorable as to the employment of machines, but it was not until 1797 that the Admiralty consented to their introduction. It should have been mentioned that during the time of his manufacture of machines at Westminster and York

Street, patents were taken out describing all the different operations performed. After the Admiralty decided to adopt his machines in 1797 they were manufactured under the direction of Jeremy Bentham, and forwarded from time to time to Portsmouth and Plymouth, where they performed, so far as any record shows, all that was claimed for them.

The bills specify lathes, saws, machines for cutting tenons, for boring, also for boring augers, and squaring tools, 'and many other machines for different kinds of work.' Machines were also devised by Bentham to facilitate block making, an operation that is yet classed among the most difficult. His machines, however, for this purpose did not seem to be perfect, for in 1810 he was joined by Brunel, who had invented a machine for 'shaping block shells.' Brunel was at that time employed under Bentham to assist in the various operations, and to perfect his own machine, which had the endorsement of Bentham. In 1803, Sir Samuel, as Inspector General, advised the Admiralty to adopt many additional machines that had already been approved, and to permit the erection of steam engines to drive them, and they were accordingly ordered. The several dockyards were fitted with engines for sawing, planing, boring, tenoning, mortising, etc, and apart from better construction, and the greater experience in their use, it is fair to infer they had nearly all the functions found in modern machines for these purposes. Their labor-saving capacity is sufficiently attested by the fact that Brunel, who had perfected and assisted in their construction and operation, was rewarded by being allowed as a premium for his inventions the estimated savings of one year's work over hand labor in the dockyards, which amounted to the very large sum of £16,000.

In 1813 arbitrators were appointed on the part of the Government to settle with Jeremy Bentham, who, after the examination of numerous witnesses, allowed him the sum of £20,000 for machines furnished to the dockyards and penitentiaries. From the testimony given before this commission we learn that 'Sir Samuel Bentham prepared a system of machinery for the employment of men without skill, and particularly with a view to utilizing convict labor. In 1793 patents were taken out on these inventions to secure their exclusive use for the prisons. The testimony states that no skill was required in the use of these machines, they were introduced into the dockyards, and worked by common laborers.' The use of the machines saved nine-tenths of the labor. 'A table could be made at one half the expense by their use,' etc., which goes to show that the machines were at least effective, a claim that cannot in many cases be made for those of modern construction.

The machines and appliances for working wood that were invented and practically applied by Sir Samuel Bentham previous to the year 1800 may be enumerated as follows:

Machine for planing and forming mouldings — Improved planing and moulding machine (rotary)— Wedge guard for circular saws — Segmental circular saw — Conical cutters for dovetail grooves

— Undulating carriage to form wave mouldings — Compound cutter heads to work two or more sides at once — The slide rest — Tubular boring implements (core boring)— Crown saws (or cylinder saws)— Reciprocating mortise machine—Rotary mortising machine—Radius arm for sawing segments — Tracer guide for sawing irregular forms — Bevel and curvilinear sawing — Machine for grinding saw blades — Taper gauge for sawing — Grooving table — Vertical adjustment of saws in benches—**T** rebating machine—Sectional cutters—Pivoted table for mortise machines — Forked or double mortise chisels — Gauge lathe with slide rest — Rotary cutters for forming screw threads on wooden screws — Double grooving saws — Rack feed for planing machines — With many other things.

The slide rest for turning is very fully and clearly described in Bentham's patent of 1793, and ranks among the greatest inventions in engineering implements. It gave us the engine lathe, without which our modern practice in machine fitting could not be carried on.

The facts adduced will be sufficient to show that Sir Samuel Bentham is entitled to the distinction of being called the father of wood-working machines in England at a date that precludes any probability of his inventions having been anticipated in other countries. Let us not forget in looking back over this history, surrounded as we are by the more perfect art, the circumstances under which these machines were made. Imagine 'catgut' bands and grooved pulleys for transmitting rapid motion, the want of skill in the workmen to carry out his designs, the want of all our modern machines, except the hand lathe, to shape metals, the imperfect knowledge of geometrical drawing that then prevailed, the ignorance, in short, of nearly all the appliances with which we are familiar, and now consider indispensable.

We must not, however, regard the construction of the machines so remarkable as the wonderful genius displayed in the invention of the *processes*, apart from the machines themselves.

In the proceeding of a trial between the Crown and James Smith in 1848, for the repeal of a patent on sawing machinery, reported in the *Mechanic's Magazine*, there is appended a note that pays a tribute to the genius of Bentham greater than all the honors conferred on him by the government during his life, from which we quote as follows:

'Sir Samuel Bentham was the first to introduce saw mills into our national arsenals, the first also to lay down the principals of all kinds of machine saws that may be constructed, and which have never since been materially departed from. The specification of his patent of 1793 is a perfect treatise on the subject, *indeed the only one worth quoting that has to this day been written on the subject.*'

To show the acquaintance of Bentham with the laws of force and motion, and more especially to show his style of reasoning and powers of deduction, we will quote from his specification of 1791.

Speaking of motive agents, he says:

'By brute force I mean not only the strength of animals, but the force of inanimate objects, and even that of men, when employed in such a way as to require neither skill nor dexterity on the part of the person who executes it. By this means machines may take the place of human skill in this operation (planing) to as perfect a degree as in any of the manufactures on which invention has been employed so much to the honor and advantage of our country. Hence three capital advantages: 1st, the quantity of force used at one time can be increased at pleasure. 2nd, the force of men may in this way be exerted to a greater advantage than while confined, as in present practice, to a particular mode, by the necessity of care and dexterity. 3rd, the labor of the awkward and unpracticed may be used,' etc.

Although his name has not been enrolled in the highest place of mechanical fame, accorded a second, or even a third place, yet it might be safely asserted that Sir Samuel Bentham gave to the world more useful inventions than any man of his age; it might even be claimed that he has done so, leaving out the circumstances of time and conditions, but when we take these into consideration, and the value of such inventions at the first dawn of development of mechanic art in England, the proposition is reduced to a certainty. His inventions extended over nearly the entire range of useful art, manufactures of all kinds received his attention, and were all more or less indebted to his genius. Throughout the whole there can be traced a constant method, and a system of deductive reasoning, that indicate a life of labor qualified by scientific learning.

Had the talents and genius of Bentham been directed in the field of letters or science alone, a niche in Westminster Abbey would perpetuate his fame, but in that silent field, of equal importance at least, the practical development of the useful arts, he was not brought in contact with the powers that manufacture fame. Yet his is a noble lot, enshrined as he is in the admiration and grateful remembrance of engineers, who must ever accord to him a first place as a successful inventor.

Having traced the origin of nearly all kinds of wood-cutting machines to Bentham it would nevertheless be unfair to deny to others their share in the matter. We will therefore notice some of the machines invented during the early part of the present century, which period may with propriety be termed the beginning of the art.

MILLER'S SAW MILL, 1777.

The patent of Miller for a sawing machine granted in 1777, is deserving of notice as containing nearly all the elements of the modern circular-saw mill, except the propelling power. The specification being short and 'quaint' it is inserted in full, as containing in the fewest words a comprehensive description of the machine.

(British patent, No, 1,152.)
To SAMUEL MILLER, of Southampton,
Sailmaker, etc.

'NOW KNOW YE, that, in compliance with the said proviso, I the said Samuel Miller, do hereby declare that my said invention of an entirely new machine for the more expeditiously sawing all kinds of wood, stone and ivory, is described in the manner following (that is to say):

'The machine that gives the power, a horizontal windmill. The shaft of this mill stands vertical, with four levers fixed to it at right angles with the shaft, to which levers are fixed the sails. These sails when in motion are one half of their time horizontal, the other vertical. The upright shaft being in motion communicates its power to a horizontal shaft. This shaft hath a large wheel to it, round which goes a rope or chain, which is continued to a smaller; through the small wheel goes a square bar of iron that receives the saws, *which are a circular figure.* Those saws being in motion, the matter or substance they are to cut is brought forward as follows: The horizontal shaft, as mentioned before, hath a small wheel on it with a groove to receive a rope, the rope is continued to a smaller that hath a pinion to it, connected to a straight bar under the chariot, which hath teeth to match the pinion; the chariot moves in a groove likewise on a center, it hath two motions, one to advance forward, and the other sideways, which is performed by a screw annexed to the end of the chariot. This screw is turned by hand to direct the pieces against the saws, agreeable to any line wanted to be cut.'

There is no doubt but that this patent, now *one hundred and eighteen years old*, indicates the first that was known of circular saws in England, and as such is entitled to no small share of interest as an invention. This machine of Miller's was a fully-organized sawing machine, fitted with a carriage having a compound movement, and, to use the modern terms of English makers, a 'rack bench' with lateral adjustment. We must, however, conclude that Mr. Miller used undoubtedly the most appropriate and comprehensive name 'sawing machine' instead of 'bench,' which technically should convey an idea of something quite different.

BRAMAH'S PLANING MACHINE, 1802.

Passing over the patents of Sir Samuel Bentham of 1791 and 1793, we come to that of Joseph Bramah of 1802.

Taking into consideration the nature and scope of this patent, with its early date, and considering the subsequent history of wood machines, it is safe to say that with the exception of Bentham's, it was the most important invention made during a term of forty years. The portion of this patent of Bramah that relates to planing was the

origin of what may be termed 'transverse' or 'traverse' planing machines, a type that to this day, with but little modification of his plans, is found in nearly all large factories for working wood.

The description contained in the specification is so clear, that we can do no better than use the words of the inventor, in which he declares the principles and objects of his invention are:

'To shorten and reduce manual labor, and the consequent expenses which attend it, by producing the effects stated in my patent by the use of machinery, which may be worked by animal, elementary, or manual force, and which said effects are to produce straight, true, smooth and paralleled surfaces, in the preparation of all the component parts of work, consisting of wood, ivory, horn, stone, metals, or any other sort of materials or composition usually prepared, and render it true and fit for use by means of edge tools of every description. I do not rest the merits of this my said invention on any novelty in the general principle of the machinery I employ, because the public benefit I propose will rather depend on new effects produced by a new application of principles already known, and machinery already in use for other puposes in various branches of British manufacture. This machinery, and the new manner of using it, with some improvements in the construction, together with sundry tools and appendages never in use before, are particularly described and explained hereunder. I mean to use and apply for the purposes above stated every kind of edge tool or cutter already known, either in their present shape, or with such variations and improvements as the variety of operations I may encounter may severally call for. But the tools instead of being applied by hand as usual I fix as judgment may direct, on frames drove by machinery, some of which frames I move in a rotary direction round an upright shaft, and others have their shaft lying in a horizontal position, like a common lathe for turning wood, etc. In other instances I fix these tools, cutters, etc., on frames, which slide in stationed grooves, or otherwise, and like the former calculated for connection with, and to be driven by machinery, all of which are hereafter further explained and particularized. The principal points on which the merits of the invention rest are the following:

'First.—I cause the materials meant to be wrought true and perfect, as above described, to slide into contact with the tool, instead of the tool being carried by the hand over the work in the usual way.

'Secondly.—I make the tool, of whatsoever cutting kind it be, to traverse across the work in a square or oblique direction, except in some cases where it may be necessary to fix the tool or cutter in an immovable station, and cause the work to fall in contact with it by a motion confining it to do so similar to the operations performed on a drawing bench.

'Thirdly.—In some cases I use, instead of common saws, axes, planes, chisels, and other instruments usually applied by hand, cutters, knives, shaves, planes, and the like, variously, as the nature

of the work may render necessary, some in form of bent knives, spokeshaves, or deep-cutting gouges, similar to those used by turners for cutting off the roughest part. I also apply planes of various shapes and construction as the work may require, to follow the former in succession under the same operation, and which latter I call finishers.

'Fourthly.— The cutters, knives, etc., I fix on frames of wood or metal, properly contrived for their reception, and from which they may easily be detached for the purpose of sharpening and the like. These I call cutter frames. These cutter frames I move in cases like those on which the saws are fixed in a sawing mill, and sometimes to reciprocate in a horizontal direction, confined and stationed by grooves or otherwise, as may be found best calculated to answer the several works intended. In other instances, and which I apprehend will generally have the preference, I fix cutter frames on a rotary upright shaft, turning on a step, and carrying the frame round in a direction similar to the upper millstone, and sometimes I cause the frames to turn on a horizontal shaft just resembling the mandrel of a common turning lathe, or those machines used for cutting logwood, etc., for the dyers' uses. When these frames are mounted in any of the foregoing directions for cutters, planes, etc., are fixed so as to fall successionally in contact with the wood or other materials to be cut, so that the cutter or tool calculated to take the rough and hilly part operates the first, and that those that follow must be so regulated as to reduce the material down to the line intended for the surface. These cutter frames must also have the property of being regulated by a screw or otherwise, so as to approach nearer the work, or recede at pleasure, in order that a deeper or shallower cut may be taken at discretion, or that the machine may repeat its action without raising or depressing the materials on which they act. The manner of thus regulating the cutter frames when on an upright shaft is particularly described below. These cutter frames may be made of any magnitude and dimensions the work requires, only observing to make the diameter of those on a rotary plane so as to exceed twice the width of the materials to be cut, as the said materials must slide so as to pass the shaft on which the cutter frame revolves when on the upright principle.'

Comprehended in this patent, and described at great length and exactness by the inventor, is the liquid bearing for stepping vertical shafts, the subject also of a 'recent invention' that came under notice.

Bramah, however, not only invented the liquid bearing, but went further. He performed the vertical adjustment of his cutter spindles by the same means, pumping in the liquid at will, and securing a very precise, as well as positive, method of setting his machine. This mode of adjustment does not seem to have occurred to the modern inventor, and the 'hydrostatic adjustment,' which has so many parallels in modern practice, may, for all the author knows, owe its origin to this device of Bramah's, but whether it does or not

the originality of the thing with him cannot be questioned. In his time engineering discoveries and engineering knowledge were not heralded through the world as fast as known, and we must in order to be even impartial give these old inventions the benefit of all doubts that may arise as to their originality.

Another still more important feature of this invention was what we term step gearing for varying motion, now extensively employed in modern engineering practice for regulating the feeding mechanism of lathes and other metal-cutting machines, as well as in wood machines.

The description is so quaint and ingenious that there needs no apology for inserting it here in full, a little allowance can, however, be suggested as to the maximum speed suggested by a compounding of these cones of wheels, as described by the inventor.

In speaking of the carriage movement he says :

'I regulate the motion of both these parts of the apparatus, as before mentioned, by means of a new invention, which I call an universal regulator of velocity, and which is composed as follows, *viz:* I take any number of cog wheels of different diameter, with teeth that will exactly fit each other through the whole, suppose ten, or any other number, but for an example say ten, the smallest of which shall not exceed one inch in diameter, and the largest suppose ten inches in diameter, from one to ten. I fix these ten wheels fast and immovable on an axis perfectly true, so as to form a cone of wheels. I then take ten other wheels exactly the same in all respects as the former, and fix them on another axis, also perfectly true, and the wheels in conical graduation also, but these latter wheels I do not fix fast on their axes like the former, which are fixed. All those latter wheels I have the power of locking by a pin or otherwise, so that I can at discretion lock or set fast any single wheel at pleasure.'

In 1808, four years later, there was granted to William Newberry, of London, a patent for a band machine. The title is that of a machine for sawing wood, splitting and paring skins, etc. Supposing this to be the origin of band saws, which, from the want of any facts to the contrary, we will assume, it was a remarkable invention, not perhaps so much for the idea of an endless saw blade, but for the fact that a machine so perfect and operative as a whole should be constructed and then lie dormant for a period of forty years.

It is easy to imagine the hopes and expectations that agitated the mind of the inventor of a thing that gave promise, as this must have done, of becoming at once the greatest of inventions, supplanting all other methods of sawing, as well as giving a continuous movement to cutting edges for paring, slitting, etc. Nor was the inventor wrong in such hopes, if he entertained them. Little did he think it would require more than two generations to develop a thing apparently so simple. Such, however, was or is the fact, for we are just now demonstrating the capacity and adaptation of band saws, a matter that will be spoken of under its proper head.

Feeding rolls and radial guides were provided very much as now

constructed, and sufficiently complete for the uses intended; also a pivotal table having its axis in the plane of the top, a thing which most regard as a modern invention.

THE BLANCHARD LATHE.

We come now to the patent of Boyd or Blanchard, of 1822, for duplicating forms in wood, as well as in other materials. So clearly defined was the principle or mode of operating that the courts in the many cases of litigation that arose over this patent never failed to see nor lay down in their decisions this principle of duplication. Neither the machine that forms the particular subject of the patent, nor the specification itself, need be reverted to here, as in the after history of the patent special mechanism was entirely lost sight of. The idea was that of using a model in conjunction with a blank, the outline of the model guiding the tool to produce a duplicate from the blank.

The invention was what may be termed an original one in the sense of not being an improvement. No analogous operation, it was believed, had ever been carried on,. either in wood or other material, and instead of being a machine, or being considered as a machine, it was looked upon as the beginning of a system from which has sprung hundreds of modifications, all sufficiently distinct to be called machines, and yet all operating on the principle of the original invention. Our modern courts define 'principle' in mechanics as meaning a mode of action, and hold that principles are not patentable, a rule that it would certainly trouble them to apply in the case of this patent, which related to a 'a mode of operating' beyond doubt. This patent, like that of Woodworth's for planing machines, hereafter noticed, was the subject of long and bitter controversies in the United States, where the incentives to its infringement were very great, owing to large profits arising from its application to making lasts, axe helves, gun stocks, and other irregular forms that were expensive to make by hand. The patent was twice extended, and expired only twenty-eight years ago in America.

To show how imperfect the records are in respect to wood-working machines, and how uncertain are law decisions in such cases, James Watt constructed in 1818 very elaborate machinery for copying. One of his machines is yet to be seen at Soho, in England, embracing all and many more methods than the one before alluded to. So perfect indeed that human busts of small size were perfectly copied, and one remains in the machine, as Watt left it at his death in 1819.

From about the year 1815 to the Universal Exhibition of London, in 1851, the manufacture of wood-working machines in England remained but a limited business, and no advance was made that at all compared with what was effected in other branches of engineering. Many machines for special uses were no doubt made and used that combined both skill and ingenuity, but upon the

whole wood machines may be said to have laid dormant in England for a period of forty years.

This is the more astonishing when we reflect that during this time the great revolution, not to say the 'origin' of engineering implements took place. Bodmer, Maudslay, Roberts, Whitworth, and others, during this time perfected the system of metal cutting and shaping machines, which have not since, and perhaps in the future will not be, materially changed. Great inventions and scientific discoveries were made, but wood machines seemed to be neglected.

In 1844, seven years previous to the Exhibition, Wm. Furness, of Liverpool, imported from the United States, and patented in England, many of the machines made by C. B. Rogers & Co., of Norwich, Connecticut. The ruling idea in these machines was economy in cost and rapid performance in the hands of skilled men, neither of which elements fitted them for the English market at that time, consequently no great use seems to have been made of the plans and modifications that they might have suggested to makers in England.

During the Exhibition in 1851, however, the performance of the 'wood framed' American machines was such as to create astonishment. English engineers at once proceeded to reproduce the methods of these machines in a heavier form, more in keeping with their common practice, and out of it grew, as we may say, a large share of modern practice in England.

In following the history of wood machines it might be said that from 1835 to 1852 the development of the art was transferred from the old to the new world. The American people without iron, or the means of adapting it to the many uses to which it was already applied in England, employed instead the wood of their forests, applying it to all conceivable uses in the construction of buildings, ships, machines, roads, and even the framing of steam engines, for which purpose it is even yet to some extent used. Necessity, which has been termed the mother of invention, coupled with a strong ingenuity and boldness of plan that has always characterized the American people, led to a rapid development of a new kind of wood machines for sawing, planing, boring, mortising, tenoning, and so on, besides hundreds of modifications of special machines adapted to the manufacture of carriages, ploughs, furniture, joiners' work, bent work, and other things.

Prominent among the inventions introduced was what is known as the 'Woodworth planing' machines. This notorious monopoly lasted by regular extension and Act of Congress over a period of twenty-eight years, costing many thousands of dollars in sixty-four suits at law which followed, crippling the interests of the country to the extent of millions of dollars, to say nothing of the many inventions in rotary planing machines that would have been developed had this monopoly been removed. We say monopoly, for the patent

of Woodworth was never accepted as a *bona fide* invention, with the scope at least that the interpretation of the courts gave it. There need be no further evidence of this given than the numerous appeals in the face of former decisions. It is true that many of these suits were in 'equity,' and did not involve directly the question of validity of the patent, but they nevertheless in nearly every instance showed that public opinion did not acquiesce in the decisions on this point. In explanation and support of the opinion expressed it must be admitted that the combination of rotary cutting cylinders and feeding rolls would in the natural development of this art have soon followed as a matter of course, and that as soon as planing by power was an industrial necessity this combination would have been invented, not by a single man only, but by a majority of as many as would attempt to make planing machines; in other words, the machine was a sequence of the state of the art, and the art was not dependent on the invention of Woodworth.

Cutting cylinders for wood were, under several modifications, known, as we have shown in a former place, thirty-five years before. In 1811 a patent was granted to Charles Hammond, of the City of London, for improvements in machinery for sawing and planing wood, in which he fully describes the use of feeding rolls for passing lumber to circular and other saws. Similar feeding rolls were used for analogous purposes in other machines and when it became necessary to move a board continuously under a rotary cutting cylinder the public would not have had long to wait for the mechanical devices forming the subject of Woodworth's specification. In fact planing thin or flexible pieces to a parallel thickness was quite a new thing, and at variance with the established plans of planing wood. In America, however, the timber is cut into thin boards in the forest, and is apt to spring, or become crooked in drying, hence the importance of a roller-feeding machine for flexible stuff, a thing not before needed, and which to this day has never become a machine of great importance, except where the system of forest-sawn thin boards prevails.

It is not the intention of the author to disparage the invention of Woodworth, and he presents these views of this old patent as coming from a practical mechanic, himself a patentee of improvements in wood machines, and as the frank expression of an opinion based upon an impartial consideration of the facts.

Since 1850 the inventions in wood machines have followed each other in rapid succession in America. The most complicated forms in wood of regular or irregular outline are produced at a cost, and with a degree of accuracy, which cannot be attained by hand manipulation. Engineers and inventors in both Europe and America, during two or three years, have been giving to wood machines such attention as they demand and the wants of the market have forced out. Within the past ten years the art has been raised to the dignity of recognition among other branches of engineering, the scientific journals of England have given more space to

such machines. Regular engineering establishments are springing up in England, America, and on the Continent, which give their attention to wood-working machines as a specialty.

Offering an apology for this recital of what we consider the leading facts in the rise and progress of this art, we feel that the book would have been incomplete without it. The facilities for gathering facts of this kind are quite limited, especially when we consider that wood-cutting machines have grown up with civilization in all countries, and have not, like many other things, been developed in one place.

As stated at the beginning, the early history of wood machines in the Netherlands would, no doubt, add many facts of interest, but as the manufacture of such machinery is now chiefly carried on in England, America, France, and Northern Germany, interest in its history is confined to its development in these countries.

THE HOWDEN SYSTEM OF FORCED COMBUSTION FOR STEAM BOILERS.

BY G. W. DICKIE, MANAGER OF THE UNION IRON WORKS, SAN FRANCISCO.

At the request of the Editor of the Magazine "INDUSTRY," I have prepared the following short statement of the main reasons why the Howden system of forced combustion has proved a success, while so many other applications of forced combustion have proved comparative failures.

The general, though I think somewhat incongruous, term "forced draught," signifies a higher acceleration of combustion in the furnaces by a supply of air from a fan or other mechanism, than can be effected by the rarification of the air in a chimney. The fullest development of forced draught is still found in the locomotive furnace.

More than sixty years ago the discovery was made that by contracting the exit of the exhaust pipe, and by placing the contracted end a short distance under the base of the funnel, a most powerful effect in the combustion of the fuel was produced by causing a partial vacuum in the smoke box. From this discovery the locomotive boiler at once sprung into life and power, making the whole machine the most wonderful of applications of steam power. After this discovery the boiler being no longer dependent on the feeble draught of a necessarily short chimney, or the conduction of heat from a few large tubes, necessitated by the feeble draught, a large number

of long and small tubes became not only possible but necessary, so that the intense heat generated in the furnace by the forced combustion might be quickly and effectively absorbed. With the great heating surface made possible by this system of forced draught the locomotive boiler thus became not only a marvel of power but of economy.

With more than sixty years' experience of the benefits of rapid combustion in locomotive boilers it appears strange that its application to marine boilers, and also to land boilers, has only begun within the last few years. Yet when we investigate the conditions under which the locomotive works, as compared with the marine engine, this apparently strange neglect becomes in a measure accounted for.

In the locomotive, a condenser, for obvious reasons, was inadmissible, and a supply of fresh water for the boilers obtainable, the whole of the rejected steam from the cylinders was available for the purpose of forcing the draught, while the boiler, with its constant supply of fresh water and frequent opportunities of cleaning, was kept in the most favorable condition for working safely at a high pressure, and at a high rate of combustion.

These conditions, so favorable to the locomotive, were not present until within the past few years in the history of the marine engine. With the ocean for a supply of water for condensation, but without any fresh water for the boilers, low-pressure steam was necessary, so that the saline deposits might be blown out, and condensers necessary so the engine could attain a fair economy. With the introduction of surface condensation, comparatively fresh water became available for the boilers. Higher pressures also became possible and safe, because of improvements in boiler making. This advance was then followed by the compound engine.

From this stage in the history of the marine engine, about 1870, a suitable system of forced draught has been possible, but the marine engineer had enough to do in dealing with the introduction of the compound engine. The changes necessary in boiler design consequent on the rise of steam from 25 and 30 pounds, to 70 and 100 pounds, and later to 150 and 180 pounds followed, and have kept him fully occupied during late years.

During this period of active change and advance in marine engineering, the subject of forced draught has often been brought forward, because of a great desire to reduce the weight and space required for engines and boilers on shipboard. Mr. E. A. Stevens,

whose name is intimately connected with steamboat history in this country, made several applications of forced draught to steamboat boilers, and it appears that in his time, between 1838 and 1850, that each of the three methods of forced draught, that of closed ash pits, closed fire rooms, and induced draught by a fan in the uptake was tried, neither of them proving satisfactory.

In 1875 Messrs. John I. Thornycroft & Co., of London, who had made a reputation for fast steam launches, and light-draft steamboats, began the construction of torpedo boats with boilers of the locomotive type, in which a high rate of combustion was maintained by means of an air-tight fire room, into which air was forced by a fan. This high rate of combustion combined with the use of high steam pressure, and a type of engine construction designed to work at a high velocity and number of revolutions, increased the speed of these light steamers so that after a few years of improvement in design and workmanship the speed was increased to nearly double what was considered possible only a few years before.

This success led to the adoption by several governments of the closed fire room system for war ships, and there is no doubt in my mind that the adoption of this system, with the difficulties attendant on its use, has retarded the general adoption of forced draught in the merchant service. It is an emergency system, and cannot be worked continuously. The high speeds obtained under it are almost entirely confined to a few hours' trial repeated at intervals, like a fire drill, to test the efficiency of the apparatus. The result of this system in war ships and cruisers is that the governments of the world, in so far as they have adopted it, possess fleets incapable of working continuously at sea at their full rated power.

It is significant that although the closed fire room is so largely used in naval practice, it has never been used except in one or two cases in merchant sea-going steamers, although the advantages of increased power, while reducing the number and weight of boilers, are of the greatest importance in merchant ships, are indeed vital conditions governing commercial success. Efficiency, economy and durability cannot be attained by the closed fire room system, hence a merchant steamer cannot afford it.

Mr. James Howden, of Glasgow, Scotland, began working on what is now known as his system in 1882. Before describing his methods it will be proper to explain the principles and conditions of working, on which a really successful system of forced draught depends.

In operating boiler furnaces under natural draught the circumstances that govern higher or lower economy may be summed up as follows:

First.— In the same boiler under normal conditions, and with equally suitable conditions for air supply, the highest evaporation economy is obtained with the lowest rate of combustion.

Second.— When the rate of combustion is increased beyond what may be termed the economical limit for a given boiler, or group of boilers, the evaporation economy decreases rapidly after the limit is passed.

Third.— The economical limit, or the point where it is found necessary to urge the fires to increase the combustion, varies in proportion to the intensity of the draught, the stronger the draught the higher is the rate of combustion before the economical limit is passed.

These effects are owing to the following circumstances:

First.— The draught of a chimney increases for obvious reasons in a much less proportion than the increase of its temperature above the surrounding atmosphere.

Second.— An increased rate of combustion under the ordinary methods of using natural draught requires in practice an increased ratio of air supply per unit of fuel burned.

Third.—An increased rate of combustion necessitates therefore not only a greater proportionate waste of heat in the higher chimney temperature required to maintain the stronger draught, but also an additional waste in the greater proportionate weight of air required per unit of fuel burned.

These conditions are well known to all having practical experience with the working of steam boilers.

The actual working of a marine boiler under natural draught will approach very closely to the following, which will serve as an illustration. The boiler we will assume has three furnaces, each 45.5 inches diameter, and fire grates 5.5 feet long, the aggregate grate surface being 60 feet.

Suppose the three following rates of combustion, namely: 12, 16 and 20 pounds per square foot of grate per hour, with respectively, 22, 24 and 28 pounds of air per pound of coal burned, and 450, 600 and 750 degrees Fah., as the respective temperatures of the escaping gases. This is a fair approximation of what would result in working the boiler with the ordinary height of chimney. The waste of heat in British units in this boiler, under these three conditions, the

atmosphere being taken at 60 degrees, the specific heat of the waste gases at .242, and no allowance made for ash in the fuel, would be,— in the first condition $12 \times 60 = 720$ pounds of coal consumed per hour, $(720 \times 22) + 720 = 16{,}500$ pounds of waste gases per hour, $16{,}500 \times (450—60) \times .242 = 1{,}562{,}932$ units of heat lost in waste gases.

In the second condition,— $16 \times 60 = 960$ pounds of coal consumed per hour, $(960 \times 24) + 960 = 24{,}000$ pounds of waste gases per hour, $24{,}000 \times (600—60) \times .242 = 3{,}136{,}320$ units of heat lost in waste gases.

In the third condition,— $20 \times 60 = 1{,}200$ pounds of coal consumed per hour, $(1{,}200 \times 28) + 1{,}200 = 34{,}800$ pounds of waste gases per hour, $34{,}800 \times (750—60) \times .242 = 5{,}810{,}904$ units of heat lost in waste gases.

These figures show the actual loss in heat units under the three conditions of working given, but the comparative values of these amounts can only be fully understood by comparing them with the total heat of combustion of the several quantities of coal consumed. These would be as follows:

Taking the total heat of combustion of the fuel without ash or moisture at 15,000 British units per pound, and the ash and moisture or non-combustible at 3 and 7 per cent. respectively, the total heat of combustion of one pound of coal would be 13,500 units. The percentage of loss would be, first, condition at 12 pounds per square foot of grate surface, or 720 pounds per hour, $720 \times 13{,}500 = 9{,}720{,}000$ units of heat, of which 1,562,932 units, or 16.08 per cent. are lost in the waste gases.

In the second condition, at 16 pounds per square foot of grate or 960 pounds per hour, $960 \times 13{,}500 = 12{,}960{,}000$ units of heat, of which 3,136,320 units or 24.2 per cent. are lost in the waste gases.

In the third condition, at 20 pounds per square foot of grate, or 1,200 pounds per hour, $1{,}200 \times 13{,}500 = 16{,}200{,}000$ units of heat, of which 5,810,904 units or 35.87 per cent. are lost in the waste gases.

After many experiments, Mr. Howden was able to so perfect his system that by its use it has become possible to greatly increase the rate of combustion, without at the same time increasing the temperature of the waste gases, thus securing the highest possible economy in fuel, and at the same time preserving the furnaces and interior parts of the boilers from injury by the inrush of cold air.

The means by which he obtained these objects, was by first

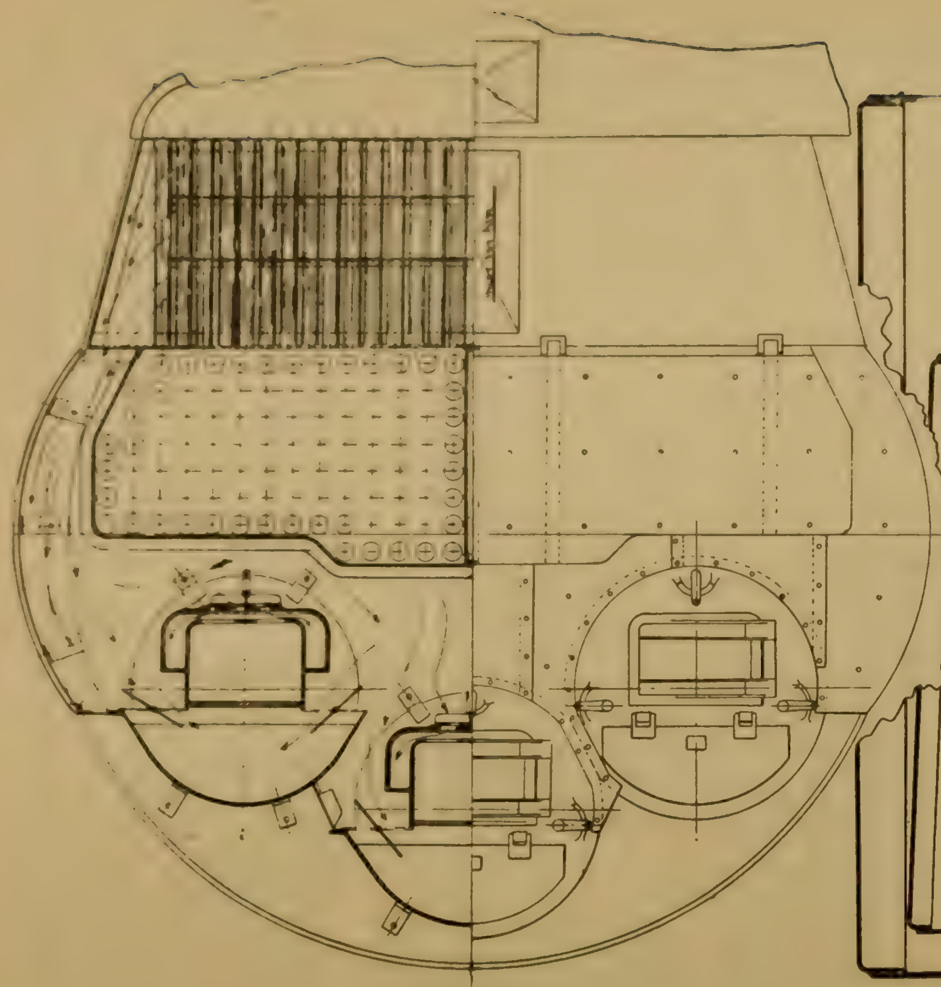


Fig. 1.

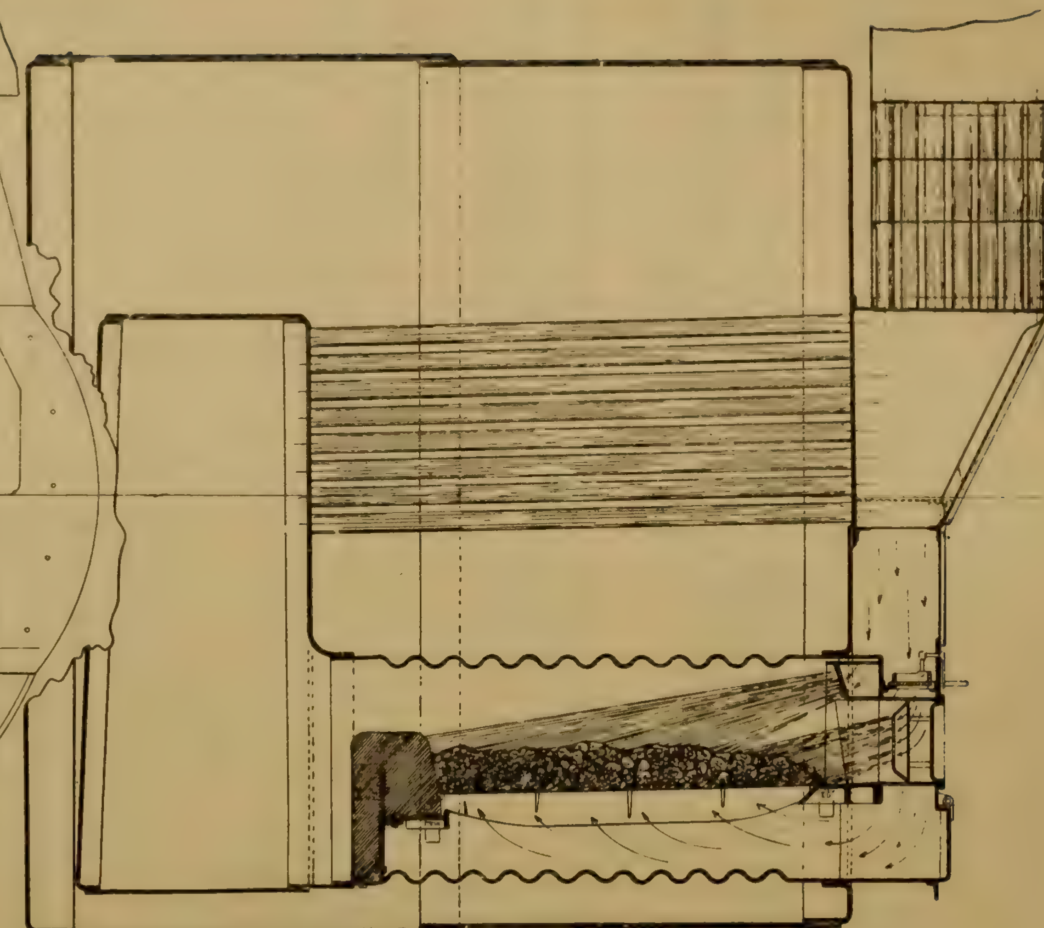


Fig. 2.

THE HOWDEN SYSTEM OF COMBUSTION.

placing an air tight reservoir or chamber on the front end of the boiler and surrounding the furnaces. This reservoir projects from 8 to 10 inches from the end of the boiler, receives the air under pressure which is passed by valves into the ash pit and over the fires in proportions exactly suited to the kind of fuel used and the rate of combustion required. The air used above the fires is admitted by its valve to a space between the outer and inner furnace doors, which swing on one hinge, the inner being the proper door of the furnace, having perforations and an air distributing box through which the air under pressure passes into the furnace and over the surface of the fuel. The outer or air tight door is not exposed to the heat of the furnace, and simply retains the air under pressure entering from the upper valve. The air from this valve, besides filling the space between the doors and passing into the furnace through the inner door, also fills the spaces above the dead plate, around the furnace door and into fixed air distributing boxes, covering the whole surface that closes the mouth of the furnace. In this manner the furnace front castings are preserved from the injurious effects of the great heat of the furnace, while the air entering under pressure is highly heated before being distributed in small jets or streams over the surface of the burning fuel so as to effect complete combustion with the smallest admission of air practicable.

By this means of balancing the air pressures above and below the fires, all tendency to blow out at the furnace door, however high the rate of combustion, is entirely removed. By regulating the valves for admitting the air above and below the fires, the highest rate of combustion possible under the air pressure used can be effected, and in the same manner the rate of combustion can be reduced to far below that of natural draught, while complete and economical combustion at all rates is secured.

In the most recent practice with this system at sea, only one ash-pit valve is opened and shut, unless the very highest power is required. The upper valve for air admission over the fires is adjusted at the beginning of the voyage to suit the character of the fuel used, and does not require to be afterwards moved during the voyage unless the engines are stopped.

If the combustion is to be suspended, as in the case of the engines being suddenly stopped, all that is necessary is to shut the air admission valves, leaving the upper one slightly open to maintain a limited circulation through the boxes. Blowing off is thus

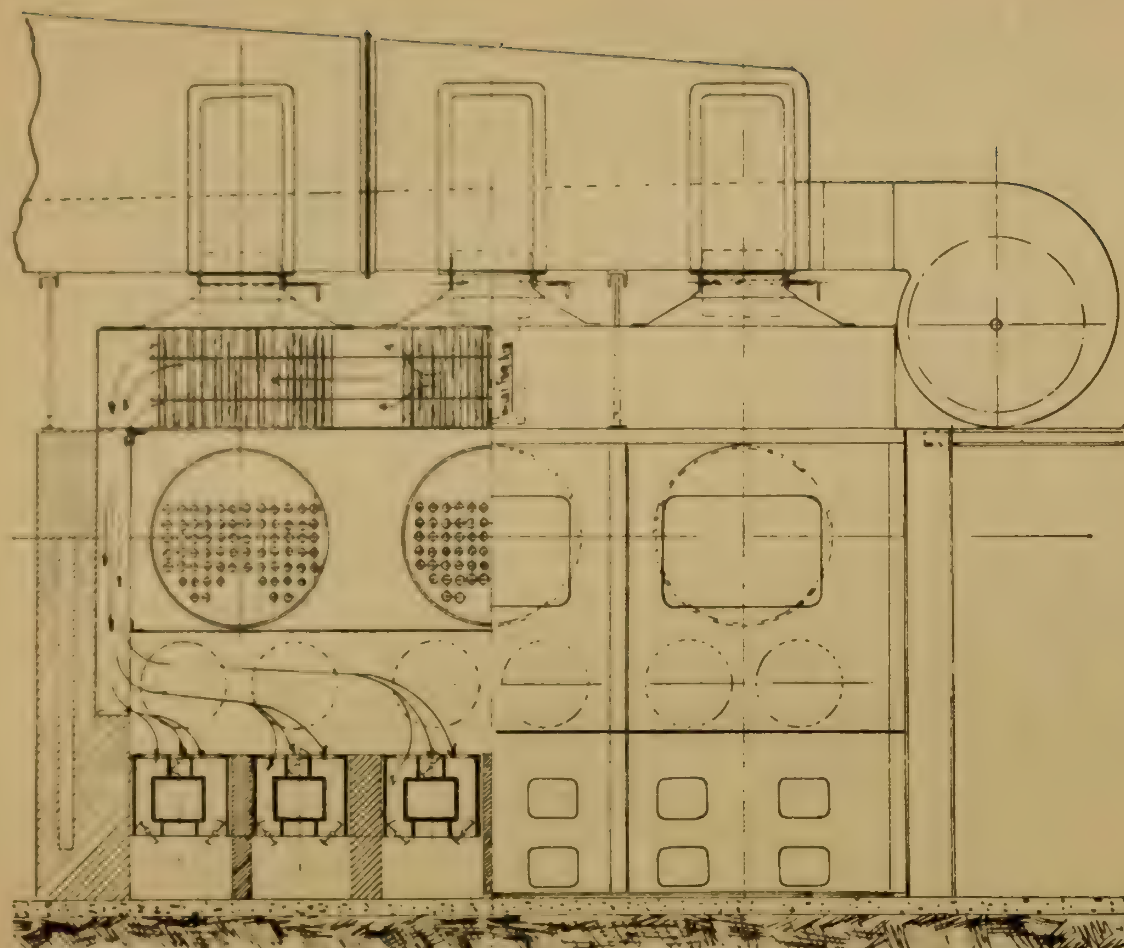


FIG. 3.

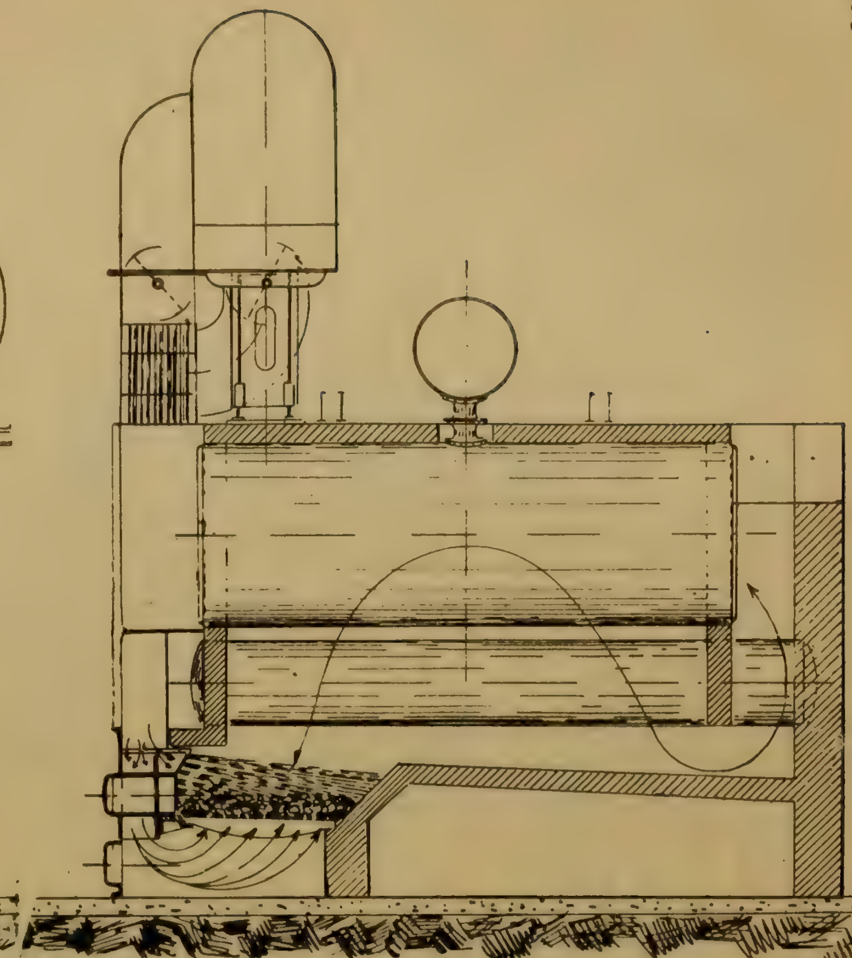


FIG. 4.

THE HOWDEN SYSTEM OF COMBUSTION.

unnecessary, and the boiler may be kept for hours in this state with combustion suspended, but with the steam pressure maintained ready for immediate use.

The most important feature, however, in the Howden system is the combination of this regulation of the admission of air to the furnaces with the heating of the air for combustion by the waste gases. This is effected by passing the hot fire gases as they leave the boiler through tiers of vertical tubes enclosed in the uptake, their lower ends being immediately above the breeching doors.

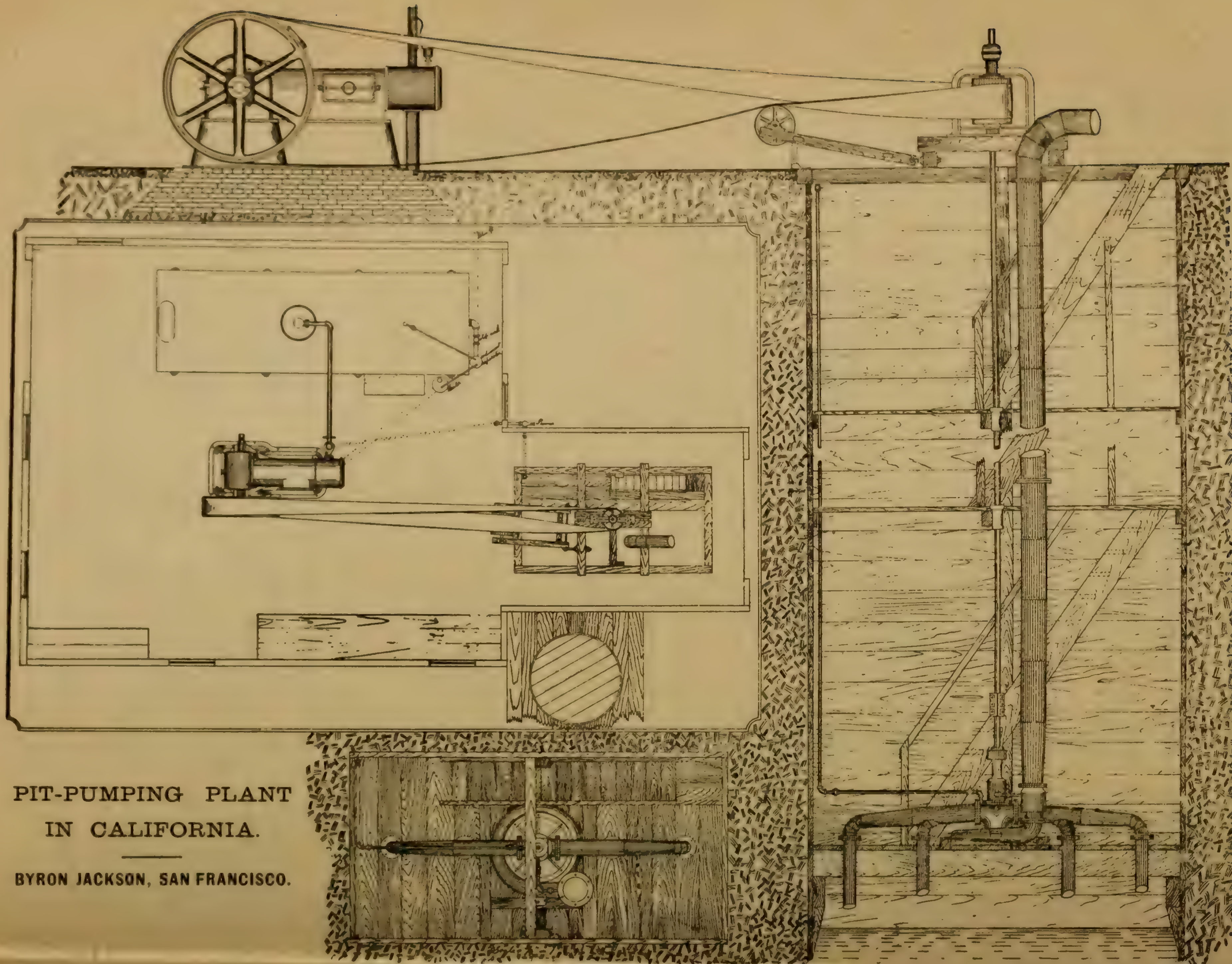
The cool air from the blower is taken in at the middle of the air-heating compartment containing the tubes, and passes horizontally among the vertical tubes to each side, and descends to the reservoir around the furnace fronts.

Figures 1 and 2 respectively show a front and side elevation, and a section through the furnace of one of the boilers of the steamship *Pomona*, of the Pacific Coast S. S. Co., recently fitted with the Howden system. These illustrations, with the description just given, will clearly explain how the system is practically carried out. For land boilers the system is applied in the same manner.

Figures 3 and 4 show front view and section of the Howden system applied to the elephant type of boiler.

After about ten years' experience with the Howden system in the merchant marine of Europe it is now acknowledged as a neccesity on all vessels that have to meet keen competition, because not only does it insure high economy, but also reduces the space and weight required for boilers at least one third. And if it has been so successful where the use of high class fuel is almost universal, it must be doubly so on the Pacific Coast where the fuel is nearly all of an inferior quality. It must be remembered that it requires as high a temperature in the smoke pipe to produce a natural draught for inferior fuel as it does for that of the highest quality.

This is a fact often lost sight of in trying to account for the fact that poor fuel is a great deal worse for steam producing than its heat capacity compared with good fuel would warrant us to expect. It takes quite as much air under natural draught to burn poor fuel as to burn good fuel, and more must be burned per foot of grate. If we take the third condition that was given, of burning fuel by natural draught, using coal with a total heat of combustion per pound of 13,500 units, which is first-class steam coal, and substitute for it our Coast coals, with about 9,000 heat units per pound, the temperature of the escaping gases being the same, 750 degrees,



PIT-PUMPING PLANT
IN CALIFORNIA.

BYRON JACKSON, SAN FRANCISCO.

and the volume the same per 1,200 pounds consumed per hour, there would be 5,810,904 units of heat lost in the waste gases as before, but instead of that loss being out of a total of 16,200,000 heat units it would be out of 12,000 $\times$ 9,000 = 10,800,000, or 53.8 per cent., instead of 35.87 in the case of good coal, so that any device that will return a large proportion of the waste heat to the furnace will be of greater value when applied where inferior coal is used for fuel. In fact our inferior coals, by the Howden system, have a value for steam production equal to their heat capacity as compared with that of the best qualities of steam coal. The question of how best to burn inferior coals is one of very great importance on the Pacific Coast, and we know of no more satisfactory answer to it than a general adoption of the Howden system of forced combustion.

CENTRIFUGAL PUMPING FROM PITS IN CALIFORNIA.

BYRON JACKSON, SAN FRANCISCO.

We have frequent inquiry respecting the use of centrifugal pumps employed in the valley districts of Californa in raising water for irrigating purposes, and publish the drawing opposite to assist in explaining the system, which is in many respects peculiar to this Coast.

An oblong rectangular shaft is sunk in the dry season, as deep as possible, that is, as long as the water can be cleared for working. These shafts or pits are rectangular, usually half as wide as their length, the latter being from 6 to 12 feet. They are lined with redwood planks, 2 $\times$ 12 inches, "half notched" in the corners, so as to require no framing, except struts or cross braces. The curbing or lining is inserted from the top as the pit is sunk, a twelve-inch section being put in as soon as the excavation is deep enough to receive it.

A temporary pumping plant is commonly employed, so as to sink the shaft below the standing level of the water at the dry season, which may be from 40 to 80 feet below the surface. These pits are not, however, the source of supply. When the whole is finished, that is, when the pit is down as far as possible the artesian well borer is sent for, and from one to four wells are bored in the bottom of the pits, from 50 to 200 feet deep, passing through the water-bearing gravel strata, careful note being made of the formation as the wells progress, also exact measurements of the position of the gravel seams.

These artesian wells are lined with riveted pipes, coated with zinc, new sections being added as the tube sinks until a sufficient depth of water strata is gone through, then the sides of the tubes are slit opposite the gravel to permit the water to flow in. This is done with a simple kind of hinged tool that is forced outward through the sides at a number of points, making a kind of screen fine enough to prevent the entry of coarse gravel. In this operation of boring the tube wells the water is disregarded, everything being done below the surface.

When the tube wells are down, the pump is mounted on a permanent platform, as shown in the drawing, if the water level is constant enough and will not rise over the platform. In other cases the pump platform is suspended on iron rods, so as to be raised or lowered as the variation of the water level may demand, that is, if the suction distance should by sinking of the water exceed 25 feet the pumps are lowered accordingly.

The suction pipes enter on top of the pump, as shown in the drawing, and extend down into the tube wells 35 feet or more, so the water cannot fall below the intake end. If the supply is less than the pumping rate, no air can enter, and the charge of water does not run back.

The water is taken in at the top of the pump for several purposes. It permits the well pipes to be withdrawn vertically, and enables the pump shafts to be sustained by the action of the water. The weight of the pump impeller and driving shaft, weighing sometimes a ton, are balanced by the water thrust, and run in equilibrium.

The proportions, deduced mainly by experience, are unusual. The uptake pipe has usually four times the area of the pump discharge nozzle, and the aggregated area of suction pipes is larger still, so the flow is reduced to three or four feet a second. For a head of 100 feet the velocity of the impellers is about 90 feet per second at the periphery, and the revolutions from 500 to 800 per minute, according to the diameter of the impeller.

Formerly these pumps were made compound, so as to run at a lower velocity, but the simple form now prevails, even for heads exceeding 100 feet. The supply raised for orchards is from 600 to 1,500 gallons per minute, which forms quite a stream, and as much as can be managed by a distributing force of men that direct the water over the ground.

The method of driving is varied, but the one shown is typical, and simple. The pipe seen on the left of the pit is for steam to

charge the pump by means of an ejector. The tube walls are not shown, but are beneath the suction pipes, seen in the drawing. The draughtsman has drawn in diagonal stairs, but this detail need not be considered. The means of descent and ascent is by a vertical ladder, which is preferable in every way, because the arms as well as the legs are used, and a man can move faster and carry more on a vertical ladder than an inclined one. This is true of all vertical ladders properly spaced.

The water as it issues from the main pipe is a beautiful sight, as clear as crystal, and often charged with gas, so as to present a silvery appearance, but commonly carries in suspension a good deal of fine gravel that can be heard impinging against the sides of the pipes by applying one's ear to the outside.

A person not experienced in the matter does not realize what the 1,500 gallons a minute means. It is a small river, and seems out of all proportion to the diminutive little machine that impels it. The efficiency attained in these plants is from 40 to 60 per cent., which is far in excess of what will be supposed by inference, but the fact is that the machinery is commonly of a high class, with no makeshift appliances anywhere. Cords of wood and inches of water are pretty well understood among the orchardists and valley farmers, who are usually a well-educated class of people, often well versed in hydraulics and motive power.

We will now attempt to explain why centrifugal pumps are used. The first and sufficient reason is that no other kind will answer. No apparatus having rubbing contact like the pistons of barrel pumps can be maintained, because of the fine gravel. In former times when such pumps were used the leathers would wear out in ten hours or so, the pumps fill with gravel, or some other impediment arise, so the machinery could not be depended upon.

A second reason is in the first cost. A centrifugal pump usually delivers six to eight times as much water as a piston one of like size or bore, and costs originally about half as much, so the relative investment is as twelve to one, considering the pump alone, and for the whole plant together, a saving of at least one third.

There is also the reason that the bulk or dimensions of a pump being inversely as the velocity of flow there is no type of piston pumps that would not fill up the pits and prevent access to the wells. Finally there is the fact that the present methods are the evolution of twenty years of experiment as are satisfactory in every way.

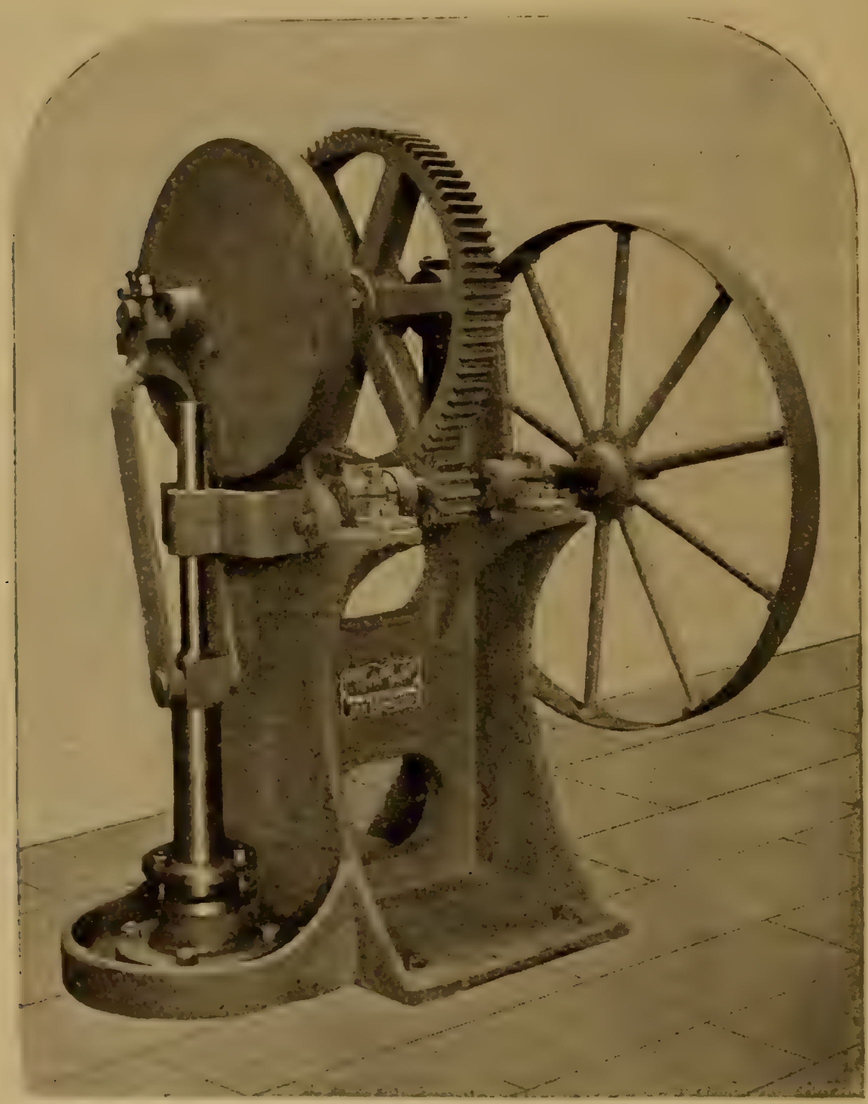


FIG. 1.

DEEP-WELL BUCKET PLUNGER PUMP GEARING.

THE DOW STEAM PUMP WORKS, SAN FRANCISCO.

The above drawing, showing the surface gearing of a deep-well pumping outfit, was left over from our articles on "Constructive Engineering Works on the Pacific Coast." It is typical of a simple and economic construction for such pumps, with the least amount of material and detail consistent with endurance.

Pumps of this kind are principally underground, and frequently extend a hundred feet or more below the surface, sometimes several hundred feet. The pump rods are made of wood, and buoyant in such degree as relieves them of excessive weight, consequently can be of any length.

The plunger seen in Fig. 1 has an area equal to one half that of the pump barrel, consequently displaces on its descent as much water as is discharged by the lifting stroke, so the flow is continuous, or equal at each stroke.

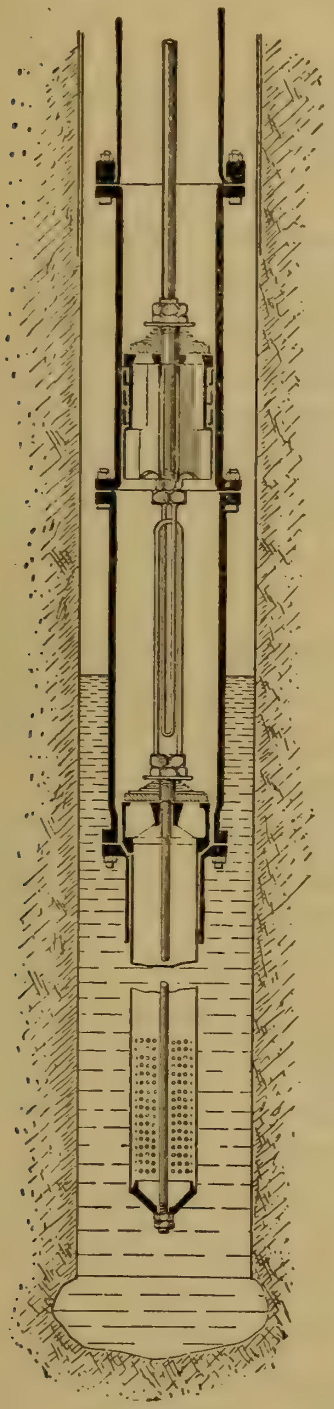


FIG. 2.

DEEP-WELL PUMP.
(*Section.*)

Pumps of this class are made with extreme care on this Coast, the barrels of brass, and all the fitting done in the most durable manner, with proportions much heavier than is common in the East. Fig. 2 shows a section of the pump at the bottom of a well, the sliding link between the piston and bottom valve being to withdraw the latter from the top.

The pumps are driven in various ways by steam or gas engines and windmills, in many cases by direct-acting engines.

The old California original of these pumps, now existing only as a relic, was a very ingenious machine, if first cost is counted among its features. It consisted of a riveted pipe six to ten inches in diameter sunk from the surface. There were usually two wells about twelve feet apart, and a rocking beam overhead, with pump rods extending down into each well. A horse power or wind wheel crankshaft was set under the rocking beam to work it at a slow speed. The tops of the pump tubes were open, and the pump rod of wood having a section equal to half the area of the pump barrel, so the water overflowed the same on both the upward and downward strokes.

The smaller pumps, such as are driven by wind wheels, have always been well made, or at least have been efficient and durable, because mostly placed in open wells and never forced like irrigating pumps, so as to start the sand and gravel. When the water is clear such a pump may go for years, but to have an "irrigation one" last as many days without new "leathers" was exceptional. The draught of water, when strong enough to raise the sand, at once destroyed the packing.

EXTRACTS FROM A NOTE-BOOK.

BY "TECHNO"

No. XXIX.

A PITCH-PINE COUNTRY.——A SCREED ON SLAVERY.——HOW TO SET A TELEGRAPH POLE.——BORING OUT A FLY WHEEL.——HOW TO SETTLE A NEW COUNTRY.——PACIFIC COAST.

————At breakfast one morning my Uncle announced his intention of going straight to New York. "You might," said he, "go round to Mobile by steamer, go down Lafourche, Plaquemine, or a dozen more trips hereabout, but it is of no use. You have seen the head and front of the river, river country and the steamer traffic, and if we should make a journey to the Pacific Coast some time, as I hope we will, it is much better to save our time and money for that. There is more room out there and more to see. I am tired of this journey."

I was not sorry at his decision, because it was obvious he felt like Marius at the ruins of Carthage. His old remembrances were of a brighter period in this country, before the carpet baggers and the railways had changed all. I knew his estimate of what we call progress, and it was not all in harmony with popular opinion. I therefore asked some questions about his intended route, remarking that we would certainly pass through a rich country until we left the Gulf level.

"Rich," said he, "look out for pitch pine, white clay and water. No one knows why there is not fifty feet of sedimentary deposit all over the country, especially from here to Mobile, which we will pass through, and perhaps there is, somewhere down below, but on top, pitch pine. This tree one may liken to the mangy dogs of Cairo, in Egypt I mean, always associated with poverty. When it is not pitch pine it is cypress and water, but of good healthy timber, or growth of anything, don't hope for it. You will not see an acre of good warm soil, or natural thrift, until we are some hundreds of feet above the Gulf. The French had a hard time to find the mouth of the Mississippi, from seaward I mean, and a heroic courage in attempting to found a city or cities when they did finally get in. They knew however what was above. La Salle had come down the other way, and the explorers well knew they were in the door to a continent. Their settlement around here, and the development of the country, is the only creditable colonial work the French

ever performed. They are not a colonizing nation, always sighing and hoping for return to *La Belle France*, and no one can wonder. Here and in Lower Canada they 'stuck it out,' as the saying is, and in the two climatic extremes of the country. How it was done I cannot imagine."

The trip to Mobile verified my Uncle's description; so did the city. From a prosperous shipping port, and great commercial city, it has become a wreck. Whole blocks with low brick buildings, iron shuttered, were quiet and desolate, grass in the streets, the wharves rotten, and the great sullen muddy Alabama River crawling by. Now and then an ill-rigged vessel loaded with pitch pine boards, perhaps some barrels of rosin, and some cotton from the interior, but not much.

Formerly it was a nigger to a bale, or a bale to the nigger, now it is a bale to the farm with the "nigger" thrown in. There are cotton "patches," perhaps plantations, but not seen from the railway, the nigger "patch" is the rule. "There seems to be something the matter with this country," said I to my Uncle, "things do not look right. It should be prosperous, and will be, perhaps, some time, but just now there is a kind of spell over it."

"Yes, Tech, you are right that far, but don't attempt to analyze the matter. It involves sentiment, roguery, philosophy, biology, sociology and history, with a smattering of thievery thrown in. Slavery is at the bottom, not as a cause direct, but as a circumstance, one may say. Do you know what slavery is? In the abstract it is an inequality of human rights, but is not an inequality of conditions. A negro may be a slave, and more free than the man who owns him. Anti-slavery is a sentiment, often an illogical one. In one sense, and a strong sense, a soldier or a sailor is a slave, so is the dependent man, and so are all men in the degree to which they must conform to the rules and laws of society.

"Southern slavery regulated by humane laws, as it might have been, and its worst features left to expire, as they would have done in time, would have been much better than a war that destroyed 350,000 men, gave the negroes a vote and a "Freedman's Bureau." It takes a great deal of slavery to balance a very little war, and not very much statesmanship to avoid both. We are hatching up another war at this time, the same kind, one that is to destroy a difference of personal rights, an inequality of human conditions, as some philosopher calls it, but I am 'running on,' and neglecting the country.

"Note these telegraph poles all leaning inward, or toward the direction of strain. The Cincinnati Southern Railway was the first and almost the only line that set poles in that manner; others set them to lean backward, away from the strain. Naturally, you would say, but wrong. When you drive a stake to sustain strain always lean it toward the pull, not away from it, as ninety-nine in a hundred are driven."

This last proposition was a new one to me, and when my Uncle went on to make a sketch and show me how by leaning the poles as seemed the wrong way the fulcra were obviously strengthened. Compression, or down strain, at the top, and upward strain at the bottom. It is perfectly simple, only common sense.

It happened to be Sunday, and fortunately too, because we saw the "blackbird" element to the best advantage. At each station, perched on fences, or sitting on logs or benches, were rows of negroes in their holiday attire. Little cotton "patches" right and left, then hills, and a beautiful country, hundreds of miles across, finally Birmingham, Alabama, where a sale of lots was going on, and people paying money in thousands that would not in their time come back in hundreds even. The "boom" idea, an insane kind of speculation not based on reason, facts, or even common sense, born of conceptions and a state of mind common to these people, isolated in trade, religion and politics. I heard two corner lots knocked down at about $3,000 apiece, that it is quite sure are not worth $300 now, and were not then by any reasoning that could be arrived at.

In time Cincinnati, Pittsburgh, Philadelphia and New York, the note-book worn, well-filled, except room for a summary by my Uncle, whose observations were not like mine, of the present only, but of the past as well.

"Tech," said he, "man is a creation of his environment, so are his works. A sparse population is provincial, and must be so, also is diversified, a mixture, so to speak. One time I saw in Kentucky a fly wheel bored with a sweep turned by a negro. They had a cast-iron boring bar passing through two floors of the building. Wooden bearings were made by bolting blocks against the floor beams. The bar extended about three feet above the upper floor, had a sweep of wood clamped on the upper end. The bar was sustained vertically by a screw-threaded rod extending up to the third floor, fitted with turnbuckles to raise the bar for feeding. The fly wheel was laid on the lower floor, and 'trammed' by the bar, a

cutter was wedged into a slot, a negro turned the sweep, another worked the turnbuckle, and a white man watched the tool. The wheel was bored in half a day at an expense of not more than three dollars, with tools not worth twenty-five dollars in all, and was bored true.

"Twenty miles away at Cincinnati (the wheel boring was done in Maysville, Kentucky) there were being made steam fire engines, also some very creditable work on mathematical instruments. That is what I call diversity, the crude and the capable in close relation. It is just so in other things. All kinds of men and all kinds of ideas come together in the western country. Madam Trollope, Anthony Trollope's mother, lived in Cincinnati then; a Dr. Mussey there was one of the foremost surgeons, so were other doctors then famous; Tosso, who lived across the river, was a famous Italian violinist and musician. Elbowing these people were the Indians, the unspeakable corncracker, the blasphemous flat boatmen. No such medley ever met in the Eastern States. Colonel Carter of Carterville, pronounced 'Catah' of 'Catahville,' in Kentucky, sometimes met psalm-singing Hezekiah Hickings, of Salem, Mass. John Murrel, professional murderer, of Mississippi, preached the gospel when there were no rich victims, but this section, now the middle of the country, while it had diversity at the time of its making up, had what the extreme West never did, that is, the honest and industrious farmer with as much land as he could use, and no more.

"Illinois was the first to experience modern methods. A railway grant took a great swath right down through the middle of the State, thousand acre farms began to appear, the 'boomer' too came, but he was a mild specimen compared to his counterpart of our time. He got up towns, marked out theaters, court houses, exchanges, churches, and all that, on paper, but the people pressed on so hard that the boomers' schemes were actually carried out, at least materialized as the spiritualists say, to an extent that a man of thirty who bought town lots, when fifty years of age saw his money come back again.

"There were no gold mines, no fruit culture at $300 an acre of product, and $900 for the land, no manufactures that were to pay 200 per cent. a year, but only farming and cattle, so the boomer was curbed in resources, his fancy could not roam beyond 100 bushels of corn to the acre, and a railway on two sides of each farm.

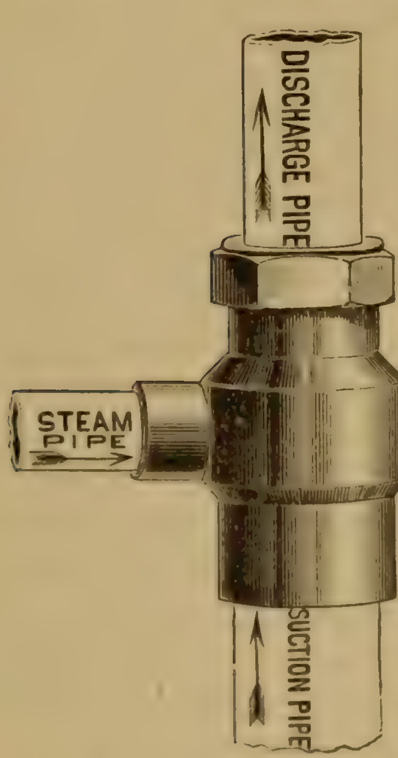
"At the Missouri things began to change rapidly, and from there on to the Pacific Ocean the settlement and development of the coun-

try followed a different plan, but this we will see some time, health and opportunity permitting. I want some salt-water service now, and will not expect an attack of land fever for some time to come. When I do I will come ashore on the other side of the continent. This railway travel I don't like."

My uncle never forgot and never changed his plans. "Do not drift with circumstances," he would say, "anchor or sail," and this he did. When he mentioned the Pacific Coast the thing was done, and now back for long months in the "works," to self denial and hard work, but the next most attractive thing to roaming with my worthy Uncle.

[End of the Second Series.]

INDUCTION APPARATUS.



We are reminded by receiving a pamphlet on "Steam Jet Pumps" from Mr. James Linforth, of this City, of various inquiries received in respect to induction apparatus for air, water and other purposes, which had to be referred in nearly all cases to Eastern firms. Considering the wide use of such apparatus for raising water and other liquids, baling vessels, clearing cellars, ventilating, blowing furnaces, charging pumps, and what may be called the "impulsion of fluids," it is strange that no one here, merchant or maker have turned their attention to this kind of apparatus as a specialty.

The present circular relates to raising water by means of a steam jet directly applied, and operating by induction, but this, while it may be the most important, is, as before remarked, but one of many uses. In Germany such apparatus constitutes a distinct and extensive branch of engineering work, and is applied to hundreds of uses, among them blowing cupolas for iron melting. German firms have branches in England and elsewhere, but in this country, or on this Coast at least, the system has not received much attention.

The drawing shows a simple form of a water-raising apparatus, said to give a fair efficiency at a trifling cost compared to a pump of like capacity.

NEWBERY'S ELECTRIC BOND FOR RAILWAYS.

Mr. George P. Low, President of the Electrical Society here, has in a communication to the American Institute of Electrical Engineers given an extensive essay on electrolysis of street pipes and iron work by return currents from the railway systems, closing with a description of a method of "bonding" invented by Mr. F. T. Newbery, C. E., of this City, that will in his opinion prevent injury to extraneous work of all kinds by return current.

Mr. Newbery's system consists of copper dowels inserted in the ends of the rails, upset or expanded by end pressure to produce a close metallic fit or union between the two metals, the dowels, two or more in number, having an aggregate section that fully equals the conducting power of the rails. We have examined joints made on Mr. Newbery's system, and its advantages are obvious. It is in fact going in the most direct and substantial manner to connect the rails by an integral copper bridge, so to call it, the whole concealed within the section of the rail itself, safe from moisture, injury or derangement.

Mr. Low sums up the particular features of the Newbery system, and with other advantages claims the almost elimination of length; maximum cross section; perfect electrical connection between the rail and bond; absolute permanence; protection against all external influences; smallest possible amount of copper; cross bonding not required; no rivets, solder, paint, screw bolts or pins; a practical equivalent of welded rails, and winds up with "no electrolysis."

We are not able to quote more than a single criticism of common methods from Mr. Low's paper, one on bonding from the web of the rails, instead of their heavy sections, and of "pass over" bonding of various kinds, and do not pretend to understand the electrical conditions involved, but from a mechanical standpoint one must certainly agree with his conclusions, that the swaged dowel in the main section is the best and most simple method of effectually bonding.

Of the triple wire bond, such as is being applied here in some cases, the author says:

"The fact is then that the rails are triple lace bonded through the web with No. 00 wire. The bond wires alone have a carrying capacity of 652 amperes at 122 degrees Fahr., but as they (being laced) make contact with the rails only by means of two holes in the web, the actual surface of steel exposed to the copper wire is but .859 square inches, whereas it should be at least 1.765 square

inches to obtain the full carrying capacity of the three No. 00 wires used. From this it is evident that the bond will carry but one half the current claimed, but after theory and practice have compromised the case, it may be found that the duty actually performed will approach the designed duty to within 20 per cent., or 25 per cent. This will reduce the advisable carrying capacity of the rail bond to less than 500 amperes."

The final conclusion is that the problem of eliminating electrolytic corrosion is in brief one of judicious bonding.

CIVIL ENGINEERS.

There seems to be some trouble in defining what the term "civil engineer" implies, or includes, and as there is no restriction in the use of this title it is made to include a good deal, commonly in this country a land surveyor, or a student just from a technological college. In Europe there is a more careful use of the term, a civil engineer is one who has not only received a course of college training, but has after that been a pupil for three to seven years to learn "practice," and a school student would never think of hanging out a sign as a civil engineer.

The latest definition we have seen includes mechanical engineering, which is humorous. There is not a competent constructing mechanical engineer in this country, or any other country, with less than twenty years of practice, and not very many of them to be found or employed. If in static or civil engineering a man is wanted, scores are ready for the place, and competent to perform almost any kind of duty such as static work involves. We do not mean, of course, school pupils, but trained men. If a constructing or mechanical engineer is wanted, where is he to be found? The few competent men are employed at high salaries, or are in business for themselves. Even a competent works foreman is not easy to find.

What is called in this country "a course in civil engineering" is no more than a similar course in dynamic engineering, and indeed not nearly so much as things go, and the latter is considered only the first stage of an apprenticeship, commanding apprentices' wages, just as a college course should do in civil engineering.

In modern times this latter term is applied to static works that do not involve machine motion, and is a science that can be taught in schools, because in nearly all phases amenable to computation, involving mainly forces and the properties or nature of material, mainly a "determinate" art, so to speak, for which there is at hand data of every kind for reference.

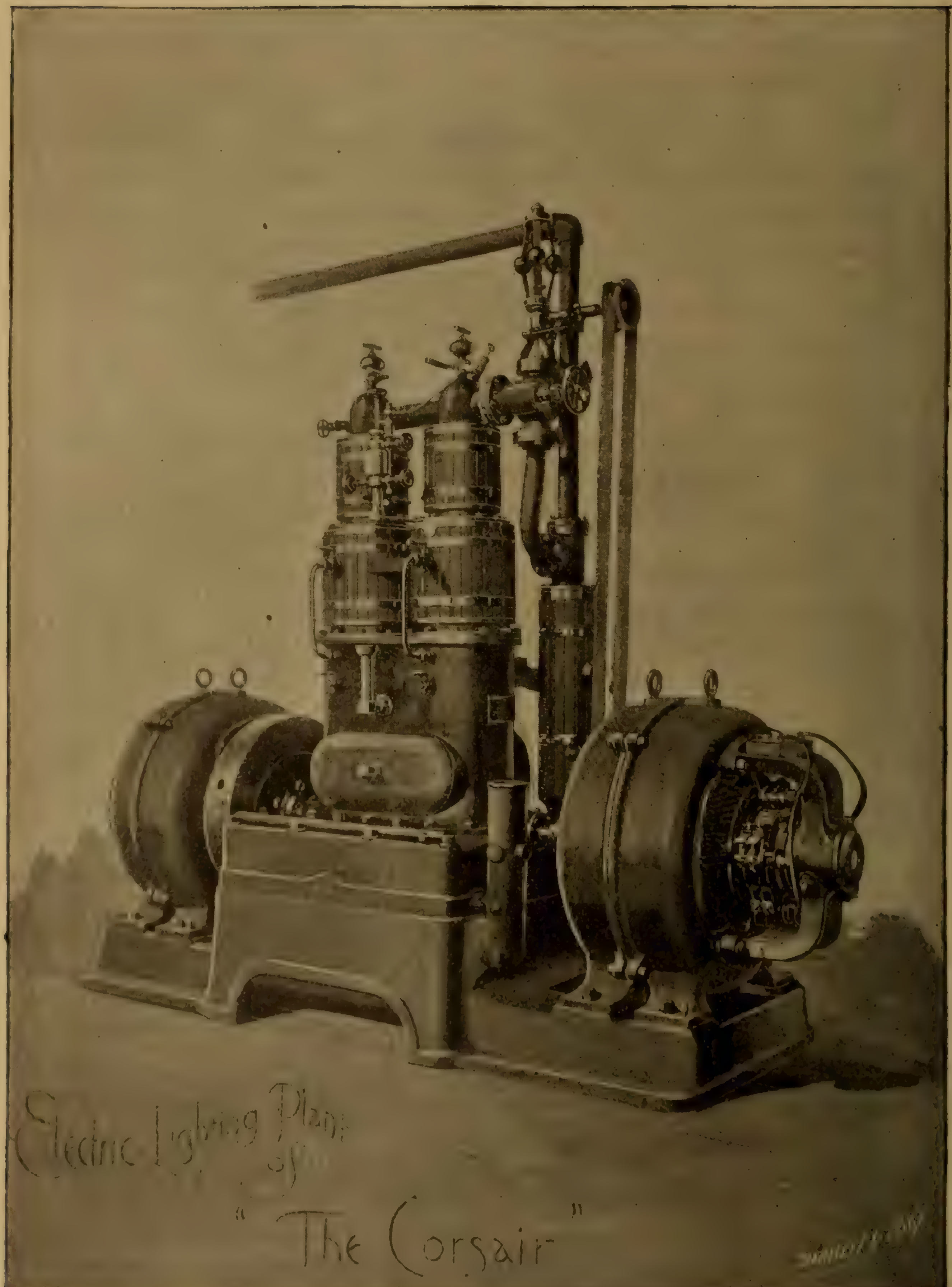
In dynamic or machinery engineering there is no such basis to work upon. As soon as machine motion enters into the case there are new and complex conditions set up, with which computation can deal only in a very limited way. There is nothing uniform, nothing constant. Calculated strains are immaterial compared with accidental strains. These are learned by experience only, and many years of it. The maintenance of bearing surfaces is alone a field wide enough to include a long course of study.

All this aside, however, there remains the fact before pointed out, that qualified mechanical engineers are not plenty, and are very expensive for that reason, in fact the number who attain the title of mechanical or dynamical engineer in its full sense are very few, if they exist at all. It is impossible in the varied field of constructive art to do more than study one branch out of many that are comprehended in the term "mechanics."

The need of true civil engineers of our time is not to include, but to exclude. The name is assumed to cover qualifications that bear no more relation to civil engineering than engine driving does to mechanical engineering, and the most effective way to set up a proper distinction is the means adopted in the old country, that of pupilage. It is imperative in the case of a mechanical engineer, and should with equal reason be imperative in the case of a civil engineer.

How can a man undertake the construction of works who has never seen works constructed? The computed part is not the principal difficulty. It is the hundreds, or even thousands, of expedients that are not in books or lectures, but must be learned by "contact," and cannot be learned otherwise.

Marine engineering, which is a branch of mechanical engineering, is a fair illustration of what is needed to qualify civil engineers. Leaving out the design and construction of marine engines, even their care is not entrusted to men without a long training, and an advancement by stages up to the first rank, consuming not less than a dozen years, and oftener twenty. One reason for this is responsibility, a marine engineer must know his duties. His mistakes bring immediate consequences, it does not require a year to see if his work will stand, a single minute will do for that sometimes. Examinations of marine engineers at this day involve a good deal more than will secure a college diploma for a civil engineer, still the pupilage or training is essential, as it is in every branch of constructive industry.



Central Valve Single Acting Engine.

CENTRAL VALVE SINGLE ACTING ENGINE.

The plate opposite, has been sent without explanation or address. It represents one of the Willans & Robinson single-acting type of engines, extensely employed in England for dynamo driving, and also made in Chicago, by Messrs. Bullock & Co. INDUSTRY has been almost alone in its support of single acting engines for a wide range of uses, and yet contends that with the same attention that has been given to other types, would occupy a still more prominent place among high speed engines.

We are not aware of what has been done in the last few years by the Westinghouse Company, or by Messrs. Bullock of Chicago, but Willans & Robinson in England, made in 1892, 26,624 horse power of these engines, and double that amount in 1894. There are now at work of these engines over 100,000 horse power, and no doubt as many if not more, by the Westinghouse Machine Co.

The engine illustrated, is we imagine for marine lighting purposes, and to run at a speed of about 300 revolutions per minute. If the makers will apprise us, proper credit will be given.

THE BASIC STEEL PROCESS.

Mr. Jacob Reese, of Pittsburgh, who it will be remembered some years ago won a patent suit, which confirmed him as the inventor of the basic steel process in this country, thus describes it :

"The basic process is so called because it is conducted in a basic-lined vessel, and in the presence of a basic slag, while the Bessemer process is conducted in an acid-lined vessel, and in the presence of an acid slag. Basic material is the oxide of metals, acid material is the oxide of metalloids. In the practice of the Bessemer process, the vessel is lined with ganister, a kind of sand rock. This old Bessemer process requires pig-iron high in silicon to develop heat while burning it out in the converter. In converting the metal into steel, this silicon is changed to silica. The steel so made always contains all the phosphorus contained in the pig-iron, fuel and fluxes from which it was made, and a considerable quantity of silicon and other impurities.

In the practice of the basic process, ganister lining is not used, but lime, magnesite, chrome ore, or other basic material. The blast furnace is worked in such a manner as to produce pig-iron for use in the basic process low in silicon, and by this means we avoid

making the dirty slag in the converter, that the acid process does in burning out a large amount of silicon. In order to develop the required heat in the basic converter, we make the pig-iron high in phosphorous, and by burning the phosphorous into phosphoric acid, we not only develop sufficient heat, but degree. Thus, by working the metal in a vessel having a pure lining and a pure basic slag, a purer and consequently a softer and more ductile steel is produced than can possibly be made by the Bessemer, or by any other process where a silicious slag is produced and maintained.

The basic process may be practiced in different ways. When practiced in a basic-lined Bessemer converter it is called the basic Bessemer process, and requires a metal containing not less than 2 per cent. of phosphorous, and less than 2 per cent. of silicon; preferably 3 per cent. of phosphorous, and less than one half of 1 per cent. of silicon. The time required in making a heat is 20 minutes.

When the basic process is conducted in a basic-lined open hearth, it is called the basic open hearth process, and may be practiced on metal containing phosphorous in all degrees, and silicon in all degrees; preferably with phosphorous from 2 to 3 per cent., and silicon below 0.50 per cent. The steel produced by the basic open hearth requires from 7 to 12 hours to heat.

The basic duplex process, consists in blowing molten metal with an air-blast, while held in an acid-lined converter until the silicon is eliminated, and the carbon is reduced to about one half of 1 per cent., then transferring the desiliconized metal (minus the slag) into a basic-lined open hearth, and there boiling out the carbon and dephosphorizing the metal in the presence of a basic slag. This process will work metal of any and every quality.

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

This Society held their regular monthly meeting March 1st, at the rooms in the Academy of Sciences Building, Mr. G. W. Dickie presiding.

L. C. Easton, C. E.; F. C. Turner, C. E.; Jos. C. Boyd, County Surveyor, were elected to membership. Loren C. Hunt and Oliver S. Goodell, Instructors, were elected as junior members.

Three names were proposed and recommended for membership, to be balloted for at the next meeting.

Mr. F. P. Medina presented and read a paper on "The Transmission of Intelligence by Electricity," which was discussed by the members.

A paper on "An Engineering Problem," by Mr. John D. Isaacs, C. E., a member of the Technical Society, was presented, and laid over to be read at the next regular meeting.

THE MANUFACTURERS' CONVENTION.

The sentiment that called together on the 18th of last month a large body of intelligent men, was commendable in so far as a general desire to increase the volume and profits of the industries of the Coast.

The term manufacture, as the circumstances proved, did not fit the case. We have here but little organized production that comes under the head of "manufactures," and the term "Industrial Convention," adopted by resolution, is more fitting and correct, if understood to embrace pursuits other than mercantile, professional and agricultural.

As remarked, the sentiment that found expression in the various papers and remarks, so far as heard and examined at the time of "INDUSTRY" going to press, was commendable, but indicates that the present session will result in little beyond organization and setting people to "thinking," but this is not a small matter.

The immediate impediments to the prosecution of skilled industries on this Coast are many, diversified and formidable, but not permanent. They are looked upon from various standpoints of view, as people are affected in their different branches of trade, and an enumeration of them will show that present circumstances are very unfavorable, also would show the uselessness of general discussion over such circumstances.

One or two of the principal impediments must be attacked first, persistently and coöperatively. The price of fuel, marine taxation and transportation charges will do for a time, and any successful work of the society in future will depend upon taking things in detail, and under harmonious effort.

There was in the Convention in several instances an out cropping of the "business by law" idea. The paternal plan of which we have had quite enough. The only way to have our home industries patronized is to excel in them, and make it to the interest of the consumer to buy here. The man who has not hope and belief in our powers to do so, will prove a poor friend to the cause in future.

All are well aware of the impediments to organized manufacture in a market so limited as this Coast affords, for all commodities that permit of duplication in quantities, and a division of labor such as exists in the Eastern States, but home patronage is not confined to products coming under this head, indeed some of these are the most

prosperous, but also shuns special industry and products that should not be successfully competed with. The subject presents great difficulty in its discussion, as the society will find in its deliberations.

Some of the circumstances attending on our manufactures, however fairly presented, are offensive to a good many, and humiliating to all. We refer to the irregularity of prices and profits. This is the bane of our industries; the fact, though small it may seem, that destroys confidence.

An experience of thirty years in various works in different parts of this country, and in some other countries, has confirmed the opinion, that among the causes that destroy patronage, none is so potent as the want of confidence arising out of irregular prices and profits. Ten cases of an undercharge and loss of profit will not compensate for one case of an overcharge. The customer who pays two dollars when one is the true price will send thousands of dollars of patronage away from local business. We do not say that profits here are large on an average, on the contrary they are small, and less perhaps than in the Eastern States, but they are not regular and uniform. Here then is one of the first things to do in all industries where work is produced to order, and its price resting on good faith; to arrive at some uniform system of prices, or as nearly so as possible, and by coöperative understanding adhere to such prices.

We are in a position to hear every day opinions of this matter, not only from those who contract and buy here, but from those who take from this Coast trade that belongs here. It is want of confidence, and the whole matter rests upon a few small transactions that do not make up a hundredth part of the whole. It is more a matter of reputation than of fact, but the effect cannot be doubted.

As before remarked, the remedy for this is coöperation to maintain fair and uniform prices, and some means of suppressing those who cast reproach upon the respectable and responsible firms who deal impartially, and maintain an uniform method in their business. To this end the efforts of an industrial association should first be directed. Then the fuel, taxation, transportation, and other problems, can be taken up one at a time, or delegated to committees.

This first thing of all, however, is to recognize and feel that some concerted action is required. The convention is an expression of this feeling. Action must follow, and will no doubt. To succeed if coöperative, to fail if divided.

The pages of "INDUSTRY" for seven years past have been

largely devoted to promoting in every way possible the expansion of skilled industry on this Coast, not by insincere laudation of what is done, but in presenting and maintaining all useful facts that bear upon the subject. The technical portion has been read and heeded, the economic part disregarded. The time has now come when the two must be considered together. This economic part involves the "management" of skilled industries, of which at this time nothing is taught in the extensive system of technical schools on this Coast.

The following is an extract from a communication on this subject sent to the Secretary of the convention :

"It is possible that among the impediments to the founding of skilled industries on this Coast one may be overlooked in the deliberations of the Convention.

To judge of such impediments the most practical way is to examine the circumstances that have attended on failure in cases where attempts have been made to found certain manufactures, and unfortunately there is no lack of cases from which inferences may be drawn.

The causes commonly assigned are high-priced labor; a lack of skill; the want of favorable economic conditions, such as cheap fuel, low rates for carriage, a wide market, and high rates of money loans. No one can deny the potency of such causes in hindering the founding of permanent industries of many kinds, but the impediment to which attention is invited is more important than any of these, or at least is a more common cause of failure — that of "administration."

An examination of suspended or abandoned attempts at certain manufactures, from watches to cement making, will disclose that the main cause was mismanagement, not culpable or blameworthy, but from a want or neglect of education in this intricate matter of "works administration."

Our colleges and institutions for technical training are sadly wanting in this branch, without which others are useless. It is distinct from almost everything now taught, and yet is the thing most needed on this Coast, where we are in a position more isolated than any other portion of the English-speaking people in respect to opportunities of observance. We have neither environment nor example, and our young men before they go into works, learn what pertains to methods, processes and records, but without knowledge of what we may call the art of administration.

The purpose of this paper is to suggest that the convention consider a resolution requesting the University of California and the Stanford University to institute a department of "works administration," relating to the practical conduct of manufacturing industries.

It is impossible within the limits of a communication like this to explain or discuss what such a branch should include. This will suggest itself to those present who are acquainted, as most all are, with

matters of management. The following may however be named: —The arrangement of plant and buildings.—Systems of piece work.—The collection of data and references.—The purchase and economy of supplies.—Protection against fire.—Apprenticeship. —Shop discipline.—Handling and shipping.—Stores and stock records.—Foreign markets.—Accounts, wages, inventory and organization.

It is hard to name or describe just what is meant, but it can be recognized as those elements that a young man is left to pick up as best he can if entrusted with responsibilities of management in a factory or works."

THE MORRIS CANAL.

The Morris Canal in New Jersey, is a most extraordinary work, but little known in this country. It connects Newark on tide water with Philipsburg on the Delaware River, 75 miles apart, and passes about 1,500 tons of freight daily. The canal is of amphibious nature, or rather the boats are, as they take to land about twenty times in passing through the canal.

The boats are in two parts, like those that were formerly hauled over the mountain top at Hollidaysburg, Pa. A late number of the *American Engineer* gives a full account and illustrations of this curious work, an Eads ship railway on a small scale, but many times repeated. The canal was first completed in 1836, and in 1845 was improved and widened, many of the haul-out planes being changed to locks and sluices. Other changes have followed, until boats of 80 tons can pass through. There are now twelve incline planes on the Eastern section, the canal rising to 914 feet, 758 feet of which is gained by the railway planes. The descent of 760 feet is made by means of eleven planes falling 691 feet, and 69 feet by locks. Water is supplied by numerous streams and rivers on the way.

One plane at Bloomfield, N. J., rises 56 feet, and is 560 feet long, or at an inclination of one in ten. The power for haulage is produced by water wheels in each case, drums and wire ropes being employed as in a mine hoist. The cars are 32 feet long, one for each boat section, arranged with eight wheels to run on ways 12 feet 5 inches apart. It is on the whole one of the strangest works on this continent, very little known, and as the editor of the *Engineer* explains, is now brought to notice by the fact of its being imitated in Japan, from careful observations made of the Morris canal system in New Jersey.

LITERATURE.

Proceedings of the International Conference on Aerial Navigation.

HELD IN CHICAGO, AUGUST 1893.

We are indebted to Mr. M. N. Forney, of the *American Engineer*, for a copy of this work, a finely-prepared volume of 430 pages, containing the papers presented before the conference.

Before speaking directly of the work it will be proper to remark that the researches in aeronaut cs, as here set forth, are perhaps the most remarkable examples of modern methods that can be referred to, declaring the avidity and resistless energy with which physical inquiry is prosecuted at this day. No one has made a flying machine, and it may almost be said no one expects to, yet here we find assembled a body of learned men, perhaps the most learned that met in any of the technical branches of the Congress at Chicago, discussing in exact terms the laws that govern aerial sustension and flight.

It causes one to think of the flying machine maker. All have known him. The poor contriver, whose stock of information consisted in the observance of the flight of birds, and who set out with paper, sticks and strings to make a machine that would "fly." His occupation is gone now, in so far as commanding confidence, or even attention.

Forty papers were presented before the conference dealing with each and every phase of the science of aeronautics, divided into the scientific principles, aviation and ballooning. Mr. O. Chanute, C. E., of Chicago, author of *Progress in Flying Machines*, and other well-known writings on aeronautics, was Chairman of the conference, and opened the proceedings with an appropriate address.

Among the many features discussed at the conference, that of soaring flight will have most popular interest. Prof. Langley's essay on the "Internal Work of the Wind," recently noticed in these columns, and that of Prof. Kress, of Vienna, seem to place beyond much doubt that such flight, that is sailing without flapping, is a function of pulsation in wind currents, or, as we may say stratification of wind currents in respect to velocities, sustension being derived from this cause. This has been the missing link, so to speak, and if a rational explanation and theory of the soaring flight of birds is reached some firmer ground will be attained in the almost hopeless feat of human flight.

A paper by Mr. J. H. Dow, of Cleveland, Ohio, related to his steam turbine, and like other published matter relating to Mr. Dows's engine wholly ignores the fact that others were engaged in the same line of invention long before his method appeared. This we must conclude is in bad taste. The Dow turbine has distinct features of construction, and nothing more, is in fact badly constructed in respect to curves or courses of the steam, and is inferior to either the De Laval or Parsons engines of the same class. We once applied for information in respect to these steam turbines, and were not furnished with any, for the reason, no doubt, that "INDUSTRY" had been dealing with the subject generally, and was too well informed.

The subject of aeronautics is a popular one, that is everyone feels an interest in the matter, because examples of flight are continually present, and the present volume, which is a library volume in every sense, will, no doubt, be widely sold, and form a *vade mecum* in the art until 1900, when another conference will be held in Paris.

The work is published by the *American Engineer*, 47 Cedar Street, New York, and costs $2.50.

Transactions of the American Institute of Electrical Engineers.

JANUARY, 1895.

The present issue of 112 pages is partially occupied by a list of members, which number 913. Two papers of interest are published. One, on the "Units of Light and Radiation," by Prof. Macfarlane, and one by Prof. A. D. Adams, on "The Best Metal for Field Magnet Frames."

This last-named paper, which has the merit of both brevity and completeness, has

in it more real practical value than a volume on "Electrical Hysteresis." Makers of dynamos and motors, now numerous all over the country, want to know whether to send their field frame patterns to an iron or steel foundry, and Mr. Adams' paper disposes of the problem. The following excerpt is all we have space for:

"I am not aware that any of the works on dynamo construction attempt a definite answer to this question, and the practice of builders is by no means uniform. Economical points of saturation requiring about the same magnetizing force per unit of length in each metal, are for the cast iron a little under 40,000, cast-steel, 70,000 to 80,000, and wrought-iron about 90,000 lines per square inch.

The cost of cast-steel is fully equal to that of forgings in simple shapes, and as it lies between cast and wrought-iron in magnetic qualities, the cost of machines made with it will be between those of cast and wrought iron. A comparison will, therefore, be made between the cost of the latter two.

To be fairly compared, machines of different materials must be equal as to magnetic flux in field and armature cores, ampere-turns on armatures, field ampere-turns required in air gaps, and as nearly as possible in magnet frames, watts used in windings, and be of the same capacities and speeds.

Taking wrought-iron at a saturation of 90,000, and cast at 40,000 lines per square inch, the section of an equivalent cast, will be two and one quarter times that of a wrought frame, and as the length of the cast-iron frame must be a little greater to give enough winding length, its weight will be about two and one half times the wrought. A saving is thus at once made in favor of the wrought magnet, as forgings can be had per pound for much less than two and one half times the cost of cast-iron."

The long discussion that followed indicates the interest in this matter, also forms a complete treatise upon the subject.

Publications of the California State Mining Bureau, 1894.

We have been favored with copies of the Report of the State Mineralogist, J. J. Crawford. Bulletins No. 2, on Methods of Mine Timbering; No. 3, on Gas and Petroleum Yielding Formations of the Valley of California, and No. 4 a catalogue of California Fossils. These publications, which come late to hand, cannot, for want of space, be fully noticed this month, but will occupy some space in a future number.

In the report of the State Mineralogist there is evidence, as in all previous reports, that this officer, and the Board of Trustees, are at a loss what to do, what to include and what to omit, and on reference to the Act under which the Bureau is established it may be seen that there are no adequate instructions on this point.

The establishment of the Bureau was most unquestionably to promulgate knowledge of the methods of mining and treating mineral, but no such declaration is found in the Act of 1893, a proper preamble would alone have been of great aid to the Board and State Mineralogist. Granting the objects to be as stated, the first thing expected would be a complete review of inventions and discoveries for the year, not only in this State, but in all others, and all over the world. The clerical labor and expense, including revision and collaboration at the end of the year, would have been a matter of little expense, and have been of great value and use to every miner in the State.

It is not an exception, and not a disparagement of the California Mining Bureau, to say there is a mistaken idea that local matters alone should be dealt with. This is true of statistics, and not true any farther. What our mining people want to know is what other people have discovered and applied in the art.

A selected list of American and foreign patents on improvements in implements and process for the past year, accompanied by a brief analysis in each case, would have been of much value, also a matter of general interest to miners, mine owners, and all concerned in the industry.

This is a mere suggestion of one way of arriving at the end sought, other plans may be better, but the purpose is clear. We have known single firms to expend in the past year sums of $50 and more in the purchase of patents to arrive at a knowledge of progress in mining implements and process.

There is also wanting a list of mines in the State. Such a list if prepared could be sold at a large price to commercial and manufacturing firms, and, as one would think, should form the first matter of record in a mining bureau, and should have been provided for in the Acts under which the Bureau has been organized.

LOCAL NOTES.

In Mr. G. W. Dickie's paper on the Howden system of combustion, published in the present number, will be found a great deal of original information of an interesting as well as very useful kind; also some of the reasons why naval vessels of our day lack the endurance and success of merchant steamers. The parallel drawn between locomotive and marine boilers in former times, and the assimilation of the system under which they operate at this day, is a thoroughly original view of the case, arrived at by intelligent investigation and experience in general steam engineering. This essay, and the record of the *Pomona* published last month, should bring the subject of better combustion and the economy of fuel before the people of this Coast in a striking manner. The present methods here are careless, to say the least, and need reform on both land and sea.

The people of this City who failed to vote for Mr. C. E. Grunsky, C. E., for superintendent of streets can find some instructive suggestions in the operations of Col. Waring, C. E., who has been appointed head of the street-cleaning department in New York. We have not space to describe what he has done farther than it is just what he ought to do, and what the people want. An engineer who has attained Colonel Waring's position in the profession is a safe man to entrust with any public function, because his business, environment and methods partake of truth and what is provable. Engineering pursuits are the antithesis of modern politics, or the chicanery by that name, so much so that no novel writer can so far violate the record as to make an engineer into a villain. Mathematics will not square with roguery.

Mr. D. B. James, of this City, wants to set up a republic or a kingdom on this Coast, so as to set at work a tariff law, and keep out Eastern products by taxing the consumers here. Mr. James' policy is not new, and is the same as that which existed in China, where Mr. James may trace out the working of his system. In one way he is right, or at least is logical. If trade restriction is a good thing, as between different countries, the same rule should apply to

different States of the Union. Our industries, such as have resources here, have now the protection of 2,000 to 3,000 miles of railway hauling, which should form an advantage of some importance, but the main point in Mr. James' scheme is that it ignores the consumer, who is a "numerous element." If the taxes of a civil government were added to the burthen now borne by the people of this Coast, we think most of them would protest.

There is now the strange and unfortunate circumstance of the people of this State and the Legislature in conflict. Almost everyone, irrespective of party, agrees and says that much of the proceedings at the Capitol are venal, useless and a scandal to the State, but as members were elected by a "representative" system, and others will be elected in the same manner, it is hard to see why complaint is made. The fault is not in the Legislature, but in the people who select and vote for such men. Mr. Ambrose Bierce recently said, in answer to the inquiry, whether the representative system was on trial elsewhere, "it is not on trial, but has been tried, convicted and is now out on a ticket of leave." The fact of this being the only country in the world where purely executive officers are elected should be widely known, because people will then begin to inquire into the matter, and end it. The election by ballot of judges of courts, for example, is too inconsistent for serious comment.

The U. S. Commissioner of Patents, on the 14th of February last, promulgated the following new rules in respect to procedure. It is an important change and should be widely published. Its legality has been questioned, but not decided.

65. An applicant will be considered to persist in his claim for a patent without altering his specification in case he fail to act in prosecution of the same for six months after the Office action thereon, and thereupon the Examiner will make a re-examination of the case.

134. In appealable cases in which no limit of appeal is fixed, no appeal will be entertained by any tribunal in the Office unless taken within six months from the action which puts the case in condition for appeal, unless it be shown to the satisfaction of the Commissioner that such delay was unavoidable.

68. In every case pending before the Office more than five years, in which the record raises the presumption that there have been intentional delays in prosecution, the Examiner may require the

applicant to show cause why the case was not more rapidly prosecuted, and at the hearing, thereon, or upon failure of applicant to appear, the Examiner will determine, under all the circumstances of the case, whether there have been intentional and unreasonable delays in prosecution, and upon finding the fact to be so, he will reject the case for that reason. Present rules 65, 69, and 134 are repealed, and present rule 68 is renumbered 69.

The foregoing rules will be in effect on and after April 15, 1895, and will affect pending cases as though the last Office action were upon said date."

The Southern Pacific Company have had constructed at Schnectady, N. Y., two locomotives for mountain work that weigh 173,500 pounds, with a wheel base 25 feet. The cylinders are 22 inches bore, 26 inches stroke. The crank shaft journals are 9 inches diameter, and the main crank pins 6 × 6 inches. The base of the engine and tender on the rails is 52 feet 9 inches, and the length over all is 59 feet 6 inches. We suppose it is a matter of experience, but it is hard to understand how the economy of such tremendous weight is computed. It must call for extra investment in the permanent way, and also in maintenance. It is a complex subject, dealt with, however, by able men, and we must accept such enormous engines as expedient. The most noteworthy feature about them is the fire box, set above the frame, and it is a wonder they do not turn over and "remain there."

Lying before us when writing this is a price list of "sun prints" from the San Francisco Blue Print Co., a bit of blue paper 3 × 6 inches, which, more than a book of a hundred pages, serves to remind one of the progress of our time. Eight years ago when our sun printing was changed to the type method, the paper for blue printing had fallen to $1.50 per roll of 10 yards by 30 inches wide, or to two cents per square foot, and the cost of custom printing to 10 cents a foot. The present list is for 25 square feet or more, .04; more than 50 square feet, .03 per foot. Times change, so do prices and customs, even the manner of writing money terms. This card is a case where values are written in terms of a dollar. Why not write ".04" instead of "4 cents," and relegate the "cts. and $" to deserved oblivion. It is not much better, or, to be exact, is just two thirds as bad as £—*s.*—*d.* of Britain. We have a decimal money system, and do not write it.

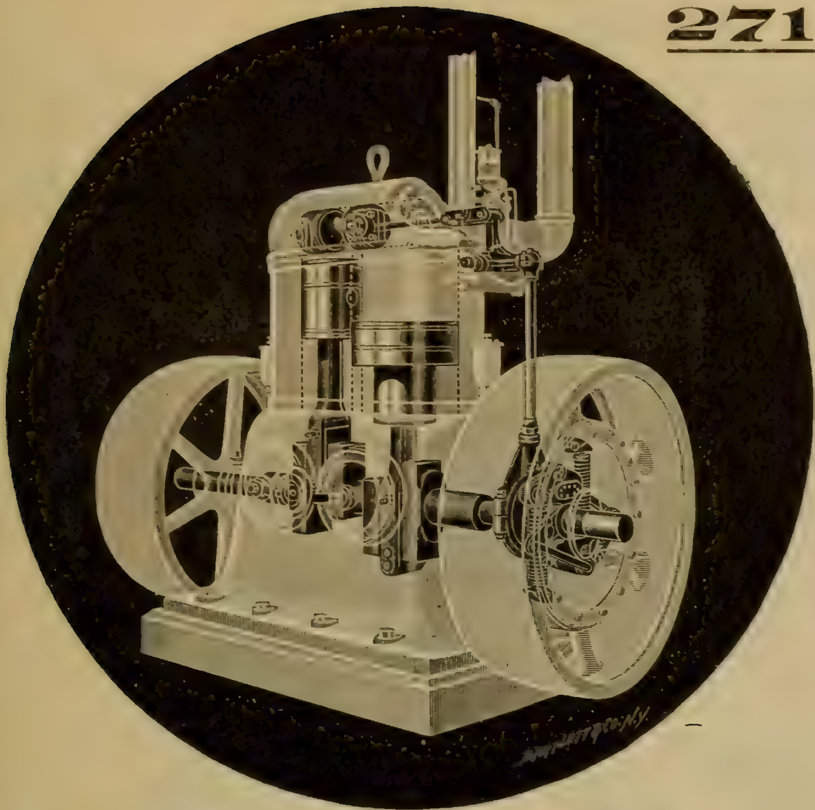
COMMENTS.

The *Blenheim*, fastest ship in the British Navy, a "commerce destroyer," to catch merchant vessels, has been sent over to Nova Scotia recently, and on the home voyage with a gale on her stern quarter most of the time, ran at an amazing rate of 14 knots an hour. The *Lucania*, which is set down in the register as ¼ knot slower than the *Blenheim*, made the same voyage at the rate of 20.41 knots. Without disparagement of the war ships of any country, it can be set down safely that their speed is a myth. The conditions of both construction and use do not admit of speed, and no one need be surprised at the run of the *Blenheim* or the United States cruiser *Philadelphia* in her recent voyage to Hawaii. This is a matter well understood by naval men, hence there are no long-maintained runs with war steamers, as with merchant vessels.

The long-continued low price of iron and steel is not without some compensation. Mr. Jeremiah Head, who it will be remembered was prominent among the members of the Iron and Steel Institute that visited this country some years ago, and who is high authority, says of American production:

"The cost of making billets in the United States, has been brought down to about 18s. 6d. per ton, and in some cases perhaps a trifle less, whereas we are not aware of any works in Great Britain where the cost has been brought under 25s. per ton, although, of course, it is possible that it may have been done for something under that figure. That this should have happened in a country where the rate of wages paid is understood to be 25 to 30 per cent. more than our own, is one of those curious economic problems that are exceedingly difficult of solution. But the effect of the fact, is that the American wire manufacturers are making havoc with our English wire trade in Central and South America, and are doing considerable business in Canada."

The Westinghouse Machine Company have issued a new edition of their circular, or treatise it may be called, relating to their single-acting engines. It is in the usual inimitable style of their publications, which is not excelled, if equaled, in the world. The works now have a capacity of three engines a day, or 900 a year, averag-



ing 60 horse power each, or more than 5,000 horse power a year, and are about to be greatly extended by new buildings 610 feet long, 230 feet wide. It is perhaps the most thoroughly-organized business of the kind that exists at this time, and has furnished many useful suggestions that have passed into other branches of industry in this country. The single-acting principle of steam-engine construction has its permanent place in motive power, not likely to be disturbed so long as steam is employed for that purpose. An engine that can be started, and run a year without stopping, adjustment, or skilled attendance, is an anomaly, if not a miracle. This, it is claimed, has been done.

State and Federal, we have now, or had last month, about fifteen thousand law makers at work in this country making laws for sixty millions of people. In each State are different codes to regulate all kinds of things, or rather to lay down rules, most of which are never heard of after they are enacted. Last month, on the 21st, was announced the passage of Acts in the California Legislature to regulate cigarette smoking, women's hats or bonnets, and women voting. This was all done by the aid of about four hundred people, not counting the promoters and lobby force. Out of some hundreds of acts nine tenths of them are to prescribe things that should be left to the discretion of responsible officers. The time has come when this nation should rise up in their wrath and put away such nonsense.

The sinking of the German mail steamer *Elbe*, that carried down with her over 300 people, will do a good deal to impair confidence in the North German-Lloyd Line, which has the largest fleet in the North Atlantic service. Twenty persons only were saved out of 355, and these nearly all belonged to the crew, and were principally officers, which, with other facts such as have been learned, point to a very loose kind of management. The ship had six or seven cross bulkheads that were evidently not water tight, or were open at the time of the collision by means of the usual doors from one division to another. That there were means and a system of closing these bulkheads we may well doubt, also must doubt if the boat service was either ready or efficient, and such opinion is based upon some observations during a journey made on one of the steamers of this line some years ago, when there was a want of a good many things tending to safety that can be seen on a British steamer.

The great Bate Refrigerator case has been decided. It has taken about three years to state a simple construction of the words of the statute in respect to American patents expiring with like foreign patents of the same inventor. This, while it is no doubt unjust, is evidently the meaning of Section 4,887 of the Revised Statutes, which in terms as plain as a lawyer can devise provides that domestic patents expire with the shortest term of a foreign patent. In the decision of the United States Supreme Court, just rendered, there seems to be no mention or cognizance of the delay that may take place in the issue of an American patent. The term dates from the time of issue, and the patent may remain for years under amendment. This is not the case in other countries, and has led to an abuse of our patent system, now corrected by the late rule of procedure elsewhere printed in this number. The Bate decision will remove one incentive for tardy procedure.

Two French battle ships, the *Magenta* and *Hoche*, are illustrated in the foreign journals, and are "fearfully and wonderfully made." Considering the tactics of the Chinese these vessels would commend themselves to that unhappy country because of their "terrible appearance." The top hamper of the *Magenta* reminds one of that picturesque structure on the top of Telegraph Hill in this City, while the *Hoche* has a conning tower, we think it is called, about a hundred feet above the water. It seems from English accounts that these fortifications were planned after the hulls of the vessels were under way, and are so heavy that the centers of gravity and "gyration" got mixed together, and metacentric stability is wanting. The ships are to be kept in smooth water. The vagaries of design in modern battle ships, makes the Norwegian Viking craft seem symmetrical.

Engineering Notes.

Several times makers of elevators have sent agents out here to show people "how the thing is done," and as often have gone home with more knowledge than they started out with. The fact is that this City has always been ahead in this "art." In years past when ram elevators were more employed, the custom in the Eastern States was to put down a well tube, then the cylinder tube inside of that. Here the cylinder tube was sunk directly, the earth being taken out

through the interior. When the tube was down a plug of redwood was sent down to close the bottom, and the whole was complete at half the cost of the double system. The hydro-steam system was invented here, and extensively applied, so were numerous other novel features. In 1876 the Palace Hotel was fitted with hydraulic elevators on the differential system, with water-controlled valves that did not appear in the East for ten years later. One of the cages was run at a speed not much exceeded at this day.

Last year "INDUSTRY," almost alone among the technical publications of this country, argued that electrical power by means of trolley lines would not succeed on the Erie Canal, or at least would not prove so successful as steam engines. How far this assumption has proved true it is perhaps too soon to determine, but it is certain the subject has lapsed into "desuetude," a thing no one will very much regret if the arrangements for a monopoly were as reported. Mr. Adams, the State engineer in New York, in a late report says the system of trolley wire propulsion is inexpedient, and inferior to steam directly applied. The only logical argument in favor of electrical apparatus for propelling boats was the possibly cheap current generated at Niagara, but there are no reasons for cheap current there, that is cheap beyond a reasonable price, and the expense of transmission, even if the current was offered at a low price, would leave a margin in favor of steam.

Messrs. Mann & Wilson, of this City, agents of the Hartford Steam Boiler Insurance Company, report for inspection in December, 1894, 18,024 boilers; subjected 747 to hydraulic tests, and found in all 12,223 defects, of which over 900 were dangerous; 47 boilers unfit for use. Of the defects nearly 2,000 were from incrustation, and over 2,000 from leaks around tube ends. Defective riveting has 1,545 cases, which is strangest of all. Incrustation and tube leaks also are to some extent from unavoidable causes, but defective riveting has no excuse. There are about as many ways of making a boiler as there are of evading the laws. Externally, and to a common observer, two boilers may seem the same, when one costs thirty per cent. more than the other to make, the weight being the same. We have just been let into some of the secrets by a boiler maker, and were astonished.

The tug boat *El Toro*, built by the Newport News Shipbuilding Company for the Mcrgan Line, has done remarkable service. The vessel was designed by Mr. Horace See, naval engineer, of New York, and is fitted with quadruple expansion engines, the only example of the kind we have ever heard of. Last year the record was as follows, the boilers being kept under full strain day and night.

Steamships towed from Company's piers to Erie Basin, or distance equal thereto	70
Steamships towed from piers Nos. 37 to 25	132
Steamships docked at piers Nos. 37 and 25	152
Lighters towed and moored	520
Miles run without tow	5342
On fire duty	Remaining time
Days in commission	351
Coal consumed per day	$1\frac{1}{8}$ tons.

In a recent number we noticed a remarkable performance of a triple cylinder engine, made at Belfast, Ireland, for a linen company there, which developed a horse power per hour with less than 12 pounds of steam. The report of the tests was full, accompanied by diagrams and the usual data, but Mr. Charles F. Porter, the veteran steam engineer, has "fell foul" of the report, and shows the result fallacious as computed. His analysis seems to be complete, winding up with the remark that "every engineer of experience knows perfectly well that an engine giving such diagrams as these, is not capable of running with economy claimed, nor with any that approaches it." The fact is, that engine tests at this day do not command much confidence when commercial considerations enter into the case. There are trials and trials, endless one may say, but without furnishing generally recognized standards.

Two ships now being constructed by a Chicago shipbuilding company, precisely alike in other respects, are to be fitted one with water tube and the other with the common marine boilers. The company have offered the use of these vessels for an experiment, and to put the trial under the direction of Commodore Melville, Chief Engineer of the U. S. Navy. This offer has been accepted, and a great deal of attention will be centered on the result, a great deal more perhaps than its importance demands, because it can not relate to much more than the evaporating powers of the boilers. It is true that the Naval officers may draw a large amount of suggestion

out of the matter, and if weights, room occupied, first cost and other like conditions are given out, other people may profit also. A main thing of all is endurance as to accidents, maintainance and life of the boilers. This can not be tried.

The *Boxer*, a torpedo boat, built by Messrs. Thorneycraft of London, for the British Navy, has run 100.6 miles in three hours, or about 33 miles an hour. This is the fastest vessel to this time, tried under careful observations, and is the ultimate no doubt, unless all other qualities are sacrificed to speed. The most remarkable thing of all in these vessels like the *Boxer*, *Daring* and *Ardent*, are the strange engine proportions, that bear no more relation to computed dimension than to the back-woods practice of the last century. No one knows just what is to happen when a pair of engines are driven to 425 revolutions per minute. The weak spot is not where it is looked for. It may be in balancing, lubrication, rotary or reciprocating strains, and the wonder is that the whole does not go to pieces. Such boats should be fitted with impulse engines, and will be before long.

Professors Slossen and Colburn, of the University of Wyoming, have instituted and conducted in a very thorough manner experiments to determine the caloric value of Wyoming coal and petroleum as fuel. The tests included coal from fifty-four different sources, and from every indication in a recently published bulletin, were the most thorough made to this time. The quantities are all given in metrical terms, which is significant. We need not consume the time of our readers in reproducing here the tables and particulars, or even the apparatus, because for all practical purposes the results confirm the common rule of "two to one," that is two pounds of coal equals one pound of oil. This is an easy rule, and as all experiments have approximated the same relation between petroleum and good coal, it is a happy escape from divergent opinions and varying results. The colorimetric apparatus employed at Laramie, was very ingenious and reliable.

The *Gascogne*, French line steamer to New York, recently broke one of her pistons, and by some ingenious repairing got into port after a long journey under slow steam. If a drawing of the piston published in the *American Machinist* is correct, no blame can be

attached to the piston for breaking in two. It was in the first intermediate cylinder of a quadruple set, and subject to a pressure of at least one hundred pounds to an inch, was as nearly as flat as a pancake, and if analyzed we imagine had no factor of safety to speak of. There is of course strong incentives to reduce the dimensions of pistons, and it is strange that so few accidents of this kind have happened. A well-arched web of short radius, and an absence of inherent strains thus gained, is the only means of safety for such pistons.

Prof. John E. Sweet has again invoked the wrath of the faithful, by criticism of American engine lathes, which if confined to the average type is perfectly correct, but there is one point he does not bring out with prominence. Turning in English shops is mainly piece work, this he remarks, also that the men prefer tools that will do the most work, in fact demand them. This is the main point of all. Suppose that lathes as we commonly make them, were put into a British shop where the contract system exists. The first day would send most of the lathes to the hospital. We have tried this and know how it is. A Putnam lathe to turn 12 inches diameter, was given to an English workman to be used for studs and the like. He took off the feed belt at once, also the traversing crank, and put one on three times as long, set a broad-nose tool to turn off small round work, feeding by hand at least one fourth inch to a revolution. The work was "cut right out," so to speak, at a piece work rate, but true and smooth. All things have a place.

ELECTRICITY.

At a late meeting of the American Society of Mechanical Engineers, in New York, Mr. Platt, one of the members, described an electric motor made in Germany, and used in Wales, England, to drive a mine pump, "when he was a school boy." This motor, a Schuckert one, ran for twelve years, down to 1883, and was then replaced by a Siemens one, now in use. This is a case of "electricity in mining" dating back twenty-four years, so the art is not quite new. The circumstance related shows that Welsh miners are not quite so antiquated in ideas as is commonly represented. They were the first to use steam engines, and now it seems were first with electric motors.

Mr. H. Ward Leonard, an engineer, who has been making a tour in Europe, examining electrical matters there, has presented his conclusions in a paper submitted at the February meeting of the American Institute of Electrical Engineers, and before saying more of this paper, we will make the claim that it has not been excelled in any contribution of the kind ever offered in this country. To use an old adage, Mr. Leonard "had his eyes wide open," also had his prejudices shelved for the time, and as a true engineer sets up a gage of truth and logic for whatever comes in his way. Nothing but a want of space, and, we may name, the author's and the society's consent, prevents us from reprinting the whole paper, instead of marring it by a few excerpts. These may however have the effect of causing the complete paper to be examined by our readers.

Mr. Leonard concludes, that in this country while we are "commercially" ahead in electrical matters, we are rapidly losing the lead from an engineering point of view, and from a class of causes that are potent in many other branches of industry. He says:

"Although I have always felt that so-called fundamental patents, and the resulting enormous aggregations of capital and engineering talent under one management, were a millstone around the neck of our profession, I have never before had the opportunity of seeing positive and unmistakable evidence of it such as this visit abroad showed me. * * * * * * * * *

A moment's thought will, I think, make you all realize that the practical development of electrical engineering improvements is almost impossible against the opposition of the gigantic corporations in that field, and that corporations having such a large portion of their capital represented by patents, will not wish to see the practical trial of a promising improvement which they do not control, and which may depreciate the value of the methods they control or claim to control. It is in just this way that we are losing ground, when compared with England and France."

The criticisms of the systems in use deserve serious consideration. They seem to be impartial.

"We undoubtedly have the best three-wire central station plants in the world, also the best alternating system, converting from 1,000 to 50 volts. But what other kind of central stations have we o point to? Practically none.

We have 500-volt continuous current electric railways galore,

and we operate such railways at distances for which 2,000 volts should be used instead of 500, and after investing more money in copper per car than the entire cost of the electrical equipment, we still lose twice as much energy as is commercial in the line.

Is there a large electric railway system in this country which as an electrical transmission of power is a credit to our profession? Not one."

The author next remarks upon a number of American inventions that he met with, things that had been presented at home but not adopted, and were afterwards taken up by English and French engineers. This remark is certainly true, and had he visited Germany, he might have added farther to his observations in this line. The concentration of the electrical interests here in a few companies, has a strong tendency to prevent the introduction of improvements outside these interests, but the fertility of invention here will after a while exhaust the resources of the great companies in buying and defending against patents. Of "rotary transformers" there is this:

"At Brighton and several other places, the standard 220-volt continuous current three-wire system, is supplemented for distant lighting and in newly occupied territory, by the alternating system using about 2,000 volts in the primary, and a 220-volt three-wire secondary.

This alternating plant supplies the distant and scattered lighting during the period of heavy load, and during the period of light load, (about three quarters of the whole time) this distant lighting is supplied directly from the 220-volt three-wire system by switching the secondary circuit from the converter to the regular three-wire system.

Mr. Arthur J. Wright, who installed this system first at Brighton, spoke of it to me as an American invention not patented in England, a description of which he had read in the American electrical journals, and was much surprised to learn that none of the central station companies had made use of it in the United States, as it was proving of the greatest value to him in his plant."

The most interesting point of all in Mr. Leonard's paper, to mechanical engineers at least, is his remarks upon impulse steam engines. Of Parsons' engines he says:

"The Parsons steam turbine was one of the most interesting things I saw in England. These steam turbines are direct, coupled to dynamos, and in sizes of 350 K. W. revolve at 3,000 revolutions per minute, and of course run at higher speeds in smaller sizes.

C. W. Hansen — A. Bain

SAN FRANCISCO STOVE WORKS

MANUFACTURERS OF

STOVES, RANGES

And all kinds of Light and Smooth Castings

622, 624, 626 Third Street, S. F.

C. W. PENNINGTON & SONS' STEEL WORKS

MANUFACTURERS OF

Best Refined Cast Tool Steel. Machinery and Hammer Steel, Steel Piston Rods, Steamboat Shafts, Dredger Buckets, Shear Blades, Lathe Spindles, and all kinds of Steel Forgings made to order.

Office and Works:

218-220 Folsom St. S. F. Cal.

EDWARD S. COBB

Mechanical Engineer and Expert

Tests and Estimates for the Improvement of Pumping, Power or Hydraulic Plants. Will Supervise the Construction, Shipment or Erection of Machinery.

Drawings, Estimates or Specifications.

Prices Obtained for Machinery of Every Description. Twenty Years Experience.

23 Davis St., Rooms 30-31, San Francisco, Cal.

C. T. CLEVE — W. H. REED

REED & CLEVE

PATTERN MAKERS

Patterns and Models of Every Description. **Machine Patterns a Specialty.** Drawings and Estimates Furnished. All work done with neatness and dispatch. **Telephone No. 5108.**

225 First St. San Francisco.

Established 1862.

THE CALIFORNIA TOOL WORKS

J. WEICHHART, Proprietor.

MACHINISTS AND BLACKSMITHS,

MODEL AND DIE MAKERS.

Steel, Iron and Brass Work. Special Tools and Machinery for all trades made to order.

Repairing in all its Branches. All work Warranted.

Telephone Main 1356.

143-145 BEALE ST., Near Howard, San Francisco.

SMITH & YOUNG

BUILDING SUPPLIES

230½ South Spring St., Los Angeles, Cal.	**723 Market St., S. F., Cal.**

Specialities.—Blue Print Paper; Casing Blocks; Deadening Felt; Infusorial Earth; Lamps, Buckeye Incandescent; Bostwick Steel Lathe; Marble; Mineral Wood; Mouldings, Turned Art; Paints, Plumbago and Malthine; Pecora Mortar Stains; Roofing; Sheathing Papers; Sash Balance and Lock, Combined; Shingle Stains; Soapstone; Spiral Balusters; Wood Carvings and Ornaments.

W. O. Fassett — P. R. Fassett

S. F. BLUE PRINT CO.

Printing from LARGE TRACINGS a Specialty

FRAME 84 X 44 INCHES

St. Ann's Building, 6 Eddy St., S. F.

Room 109.

O. Rolfson. — R. J. Rolfson.

ROLFSON BROS.

423 Bay Street

Inventors will find it to their advantage to consult Mr. R. J. ROLFSON.

Draughtsmen, Model Makers and Machinists.

A. E. CHODZKO

MECHANICAL ENGINEER

Air Machinery a Specialty

226 Market St., Room 3, San Francisco

P. O. Box 1914

A. A. McDearmon — F. Malloye

McDEARMON & CO.

ASBESTOS

Boiler and Steam Pipe Coverings

Asbestos Cemenf for Boilers, Drums, Heaters, Etc.

H. W. JOHNS CO'S. SECTIONAL COVERINGS

43 Ninth Floor, Mills Building, San Francisco.

Send for Circulars and Prices.

VAN DUZEN STEAM JET PUMPS

THE BEST IN THE WORLD.

Pumps any kind of Liquid. Always in order. Never clogs nor freezes. Fully Guaranteed. COST $7 AND UPWARD. Especially useful for Mines, Quarries, Pits, Wells, Clay Pits, Breweries, on Steamships, Ferryboats or any place where steam is available and liquid to be pumped. A full supply in stock. Address,

JAS. LINFORTH, 37 Market St., San Francisco

LEPPIEN COLLECTION AGENCY

LAW COLLECTIONS

Room I. — 110 SUTTER STREET.

SAN FRANCISCO

GERMAN LEARNED IN ONE MONTH. THE Rote Lexicon. Price 25c. THE INDUSTRIAL PUBLISHING CO., 40 California St., San Francisco.

The space occupied by a 350 K. W. outfit is over all about twenty-five feet long, five feet wide, and including governor about seven feet high. These turbine plants when running at these high speeds are entirely free from vibration, and are not even bolted down, but are supported by three pedestals, one near each end and one in the middle. * * * * * * * * * *

Tests by Professors Ewing and Kennedy, indicate that this turbine when in perfect condition, has an efficiency of one K. W. hour in electrical energy produced by 28 pounds of feed water, the turbine being operated condensing. This is equivalent to about 15.7 pounds of water per indicated horse power per hour, and I understood that in a recent competition a guarantee was made by Mr. Parsons which was equivalent to about 13 pounds per indicated horse power per hour, and that his guarantee was lower than that of the best triple compound condensing engines of the reciprocating type which were in the competition. At Newcastle-on-Tyne, I saw a central station of about 25,000 lights operated solely by these steam turbines, and which has been in operation since 1890, and has been earning and declaring dividends ever since it started.''

Of Dr. De Laval's impulse engines, there is the following:

''The power is derived from the momentum of a jet of steam impinging upon buckets near the periphery of a disk, so that the machine is somewhat comparable to the Pelton water wheel. The steam, which is preferably used at a high pressure and exhausting into a vacuum, is expanded in a nozzle before reaching the disk, and reaches the buckets of the disk fully expanded, and hence moving at a very high velocity which the inventor claims is 3,000 feet per second for steam at 85 pounds per square inch, exhausting into the air, and 3,700 feet exhausting into vacuum. The nozzle makes a very slight angle with the plane of the disk. The admission of steam is controlled by a centrifugal throttling governor. The number of revolutions of the disk per minute varies from about 15,000 to 30,000 in sizes from 5 to 50 horse power. The buckets are milled out of a solid disk of steel just inside of the periphery, so as to leave a solid band on the circumference. The edges of the buckets are quite sharp. The disk in a case of a 50 horse power turbine is about ½ inch thick.''

We propose to refer further to this paper in a future number.

MINING.

NOTES.

The Standard Consolidated Mine, at Bodie, California, at their annual meeting in this City last month, declared a fifth successive quarterly dividend of ten cents a share. The balances carried over from the previous year amounted to $259,790, and the balance in hand amounted to $53,185. Mr. Thomas H. Leggett was re-elected as president and general manager. This mine is a case of resuscitation, also an example, as we believe, of intelligent administration. The extensions and improvements of the last three years, including an additional electric plant, now being erected, have created a new property of great value from resources that have their counterpart "lying around loose" in various parts of this State. Failures in mining and other industries on this Coast are always explained on other grounds than administration, but this is frequently the real cause.

The smelting plant at Tacoma, Washington, has proved a success, and has added a good deal to the advantages of that city. About seventy-five men are employed, and a pay roll of more than $5,000 a month is a fair set off to all the whiskey saloons in the place, in so far as public benefit. The product is about $90,000 a month, and the market for ore afforded by the smelting works produces a large trade not shown in the records of that business. The product is copper, silver, and gold, the latter being about one half of the whole. Works of this kind are not a desirable adjunct when within the limits of a city or town, unless on an eminence, or provided with chimneys of great height, but there is always some way to provide for disposing of the fumes in a place like Tacoma.

Some one tells a story of one of our capitalist mine owners, who on being offered a mine of extreme richness, said: "I don't want such a mine at any price. If your ore contained $15 a ton, instead of $75, I might entertain your proposition." Rich strikes are small, and the really valuable mines of our time, that is permanently valuable, afford low-grade ore. Crushing and amalgamation have diminished in Colorado, and a large share of the ore is too poor to be treated in this manner profitably. It is not far wrong to assume

that no speculative business pays in the end. The pocket mines of California never did much good directly, because of the disturbing speculation that resulted. As mining extends to large bodies of comparatively low-grade ore, so it becomes permanent and profitable to the community around it, and to the country.

The Iron Mountain mines, in Shasta County, have, it is reported, been sold in New York for half a million dollars by some reports, and much less by others. The mines are near Redding, and produce copper, silver and gold. It is proposed by the new company to smelt most of the ore at the rate of 1,000 tons a day, which is a little too much for fair belief, a cypher less will do better. These mines, with 1,300 acres of land, make up a large property that has yielded over $600,000 worth of ore. Redding has not of late years profited much from the mining trade, but if the Iron Mountain property is started up at the pace reported it will cause a great revival in the "end city." There is a mill of twenty stamps now at the mine, and the reported scheme includes an addition of a new crushing as well as a smelting plant.

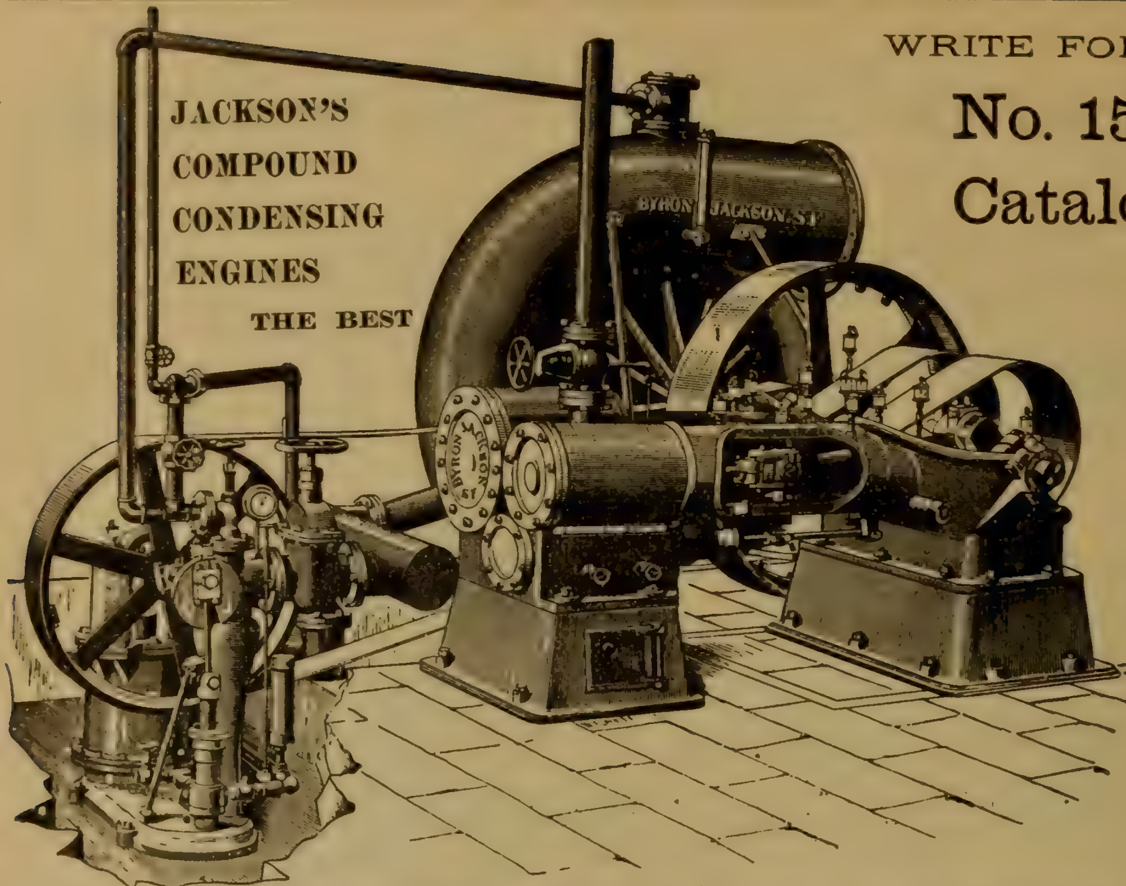
It is often a matter of wonder where the millions of feet of timber buried in the Comstock mines come from. The country around Virginia is as bare as Mr. William Nye's head, but in Lake Tahoe basin there are great forests, from which the mine supply at Virginia is drawn. The transportation is tedious and expensive, being first by rail 12 miles, then rafted across Lake Tahoe, next hauled up an incline of ten miles, and from there flumed to Carson City, where it is again transported twenty miles by rail to Virginia, the whole distance being 65 miles and over two mountains. A description of this traffic was given some time ago by Mr. William Alvord, of this City, in a paper presented before the American Forestry Association. He estimated that nearly 200,000 acres of forest had been consumed in timbering the Comstock mines. Its total value Mr. Alvord sets down at $55,000,000.

The "collapse" of the Colorado smelting combination has raised the values of ores, or, what is the same thing, reduced the price of reduction, so the association in its ending has done what was claimed for its beginning. The *Mining Industry* estimates an increase of business by increased working of low-grade ores, and

certainly $2.00 per ton will let in a vast amount of ore that could not be mined at the higher price for smelting. Strong as the smelting interest is in Colorado, the mining interest is its match. There is a greater community of interest among mine owners than in this State, and the milling companies at Virginia could never have carried on their game in Colorado as they have done in Nevada.

Some enterprising schemers at Tacoma, Washington, have staked out a portion of that city as mineral, or gold bearing, and seek to acquire on this plea a million dollars' worth of land in that enterprising city. The *Engineering and Mining Journal* says that an Inspector General of Land Offices, sent out from Washington, became a witness for the claimants and a kind of attorney in their interest. The son of a land commissioner was an attorney for them also, and the whole proceeding has an aspect of an attempt at what may be called "official theft." If the official powers and privileges of those representing the laws of the county are to be lent to such a scheme, it is time that some drastic measure, such as a dip into the bay, was set on foot by our neighbors. The gold bearing phase is considered a myth by the citizens.

The *Mining Industry*, Denver, says that Mr. J. C. Green has a lead, silver and gold mine 65 degrees north latitude, and 164 degrees west longitude, a thousand miles north of Sitka, in Alaska. The mine is worked every summer, supplies and men going up from this City, and the ore brought down here in the Autumn to be smelted. The fact in itself is not an important matter, but it indicates possibilities of a portentous kind when we consider how little prospecting has been done in this remote part of the country. The present season will reveal a good deal as to what may be expected of mines in Alaska, both on islands and on the main land. There will be many reports of great finds, no doubt, and a large amount of caution will be called for, still the chances, or even the probabilities, are that our northern possessions are to be a great field of mining for the precious metals.

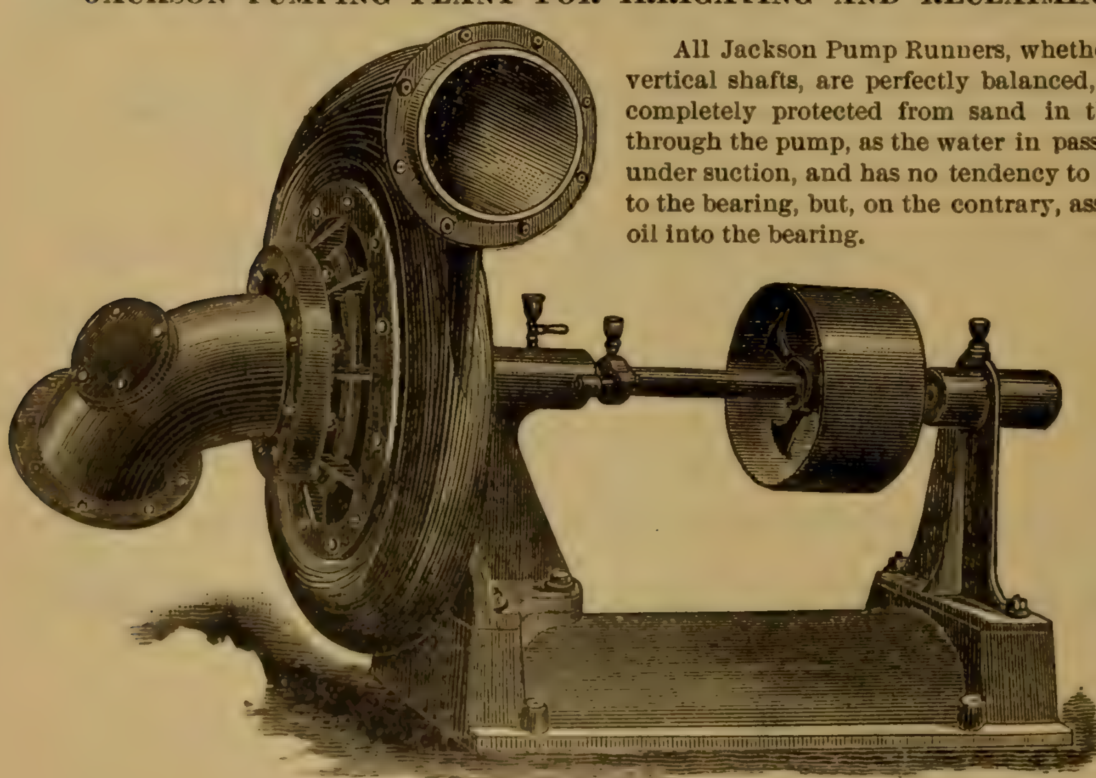


WRITE FOR

No. 15
Catalogue.

JACKSON PUMPING PLANT FOR IRRIGATING AND RECLAIMING LAND.

All Jackson Pump Runners, whether in horizontal or vertical shafts, are perfectly balanced, and the bearings completely protected from sand in the water passing through the pump, as the water in passing the bearing is under suction, and has no tendency to carry the sand into the bearing, but, on the contrary, assists in feeding the oil into the bearing.



JACKSON'S "WHIRLPOOL" CENTRIFUGAL PUMP
With cast sub-base, outboard bearing, and adjustable suction and discharge.

Byron Jackson Machine Works

— BUILDERS OF —

COMPOUND-CONDENSING ENGINES, AIR PUMPS

AND JET CONDENSERS.

Pumps for Irrigation and Reclamation, Dredging, Wrecking, Mining and City Water Works.

BOILERS AND ANY KIND OF MACHINERY BUILT TO ORDER.

625-631 SIXTH ST., SAN FRANCISCO, CAL.

MISCELLANEOUS NOTES.

There are some cases of "sham" that are commendable. For example, why should real ebony be employed for any purpose, except for policemen's clubs, or the like? It is a hard, obdurate wood, dulls tools, splits easily, is granular enough to permit screws to pull out, and is black. Sometimes finely marked, but commonly and preferably only black, so is maple or any other close-grained wood, black when stained so, can be polished just the same, and has virtues of various kinds that the expensive imported wood has not. We have worked some ebony, principally in veneers, and like it for that purpose, but as a solid wood it is, in slang terms, a "humbug." It is rich. It requires rich people to buy and move furniture made of ebony, and to buy more when it comes to pieces, which it is sure to do in time even with careful handling.

Mr. James Deas, C. E., tells in the *Engineering Review*, the story of digging out the River Clyde, at Glasgow. It is a wonderful recountal of persistant effort, by which a brook 15 inches deep at low water, has been converted into a canal or estuary, 26 feet deep. The improvements were begun in a temporary way in 1556, but not much was done until a hundred years later. In 1773 some real work began; in 1806 the channel began to be a commercial highway, with about 4½ feet of water. From then, progress was as follows: In 1821, 13½ feet; 1830, 14 feet; 1840, 17 feet; 1850, 19 feet; 1870, 21 feet: 1880, 23 feet; 1894, 26 feet. Elderslie rock, a ledge 300 feet thick, stood like a dam across the river at one place; this had to be blasted down, and removed without interfering with traffic. This work required the drilling of 16,000 holes, the length of which amounted to 90,000 lineal feet. The explosives used, dynamite principally, amounted to 76,000 pounds, and not a man was injured during all this work.

Glasgow is building an underground railway in the heart of the city, 6½ miles long, with fifteen stations; a tremendous work, and typical of what must in the end be done in New York. The trains are to be moved by cables, the system being adopted after exhaustive research, and the indorsement of the most eminent engineers. The engines are of 2,000 horse power, and the rope

gearing on the American system, including Walker's differential drums. The speed is to be at the rate of 15 miles an hour, and the fares one and two pence, second and first class. No estimates have been published, but the amount of capital required would exhaust a city less rich than Glasgow. The work has been going on for three years, and is now approaching completion. Surface works it is evident, will not do for the ultimate method of traffic in dense cities. There is no surface to spare, and the interference with personal rights and property is too great.

There is on the Columbia River, near the Cascades, a curious phenomenon, a moving mountain that is crawling down toward the river. It is six to eight miles long, and 2,000 feet high, a basaltic formation that, it is conjectured, will some time, a few thousand years hence, dam up the river and form a great lake. The forest at the base of the mountain is being crowded into the river, and a railway along the shore has to be dug back once in a while to get a new hold. The cause of the movement is supposed to be the erosion by the river of a bed of soft sandstone on which the mountain rests. This account we find in a foreign journal of good standing, and it is, no doubt, correct in so far as the subsidence of the mountain side next the river, or along the river, but as to a whole mountain 2,000 feet high moving sidewise, no one is obliged to believe that.

The need of a navy at this day, if it is to be based on any particular thing, rests in the volume of foreign or sea-borne commerce and shipping. The length of seaboard is sometimes spoken of as a measure of naval power required, but it is possible that the rule is nearer true if reversed. The sea coast of the United States, for example, is so long that all the navies of the world could not defend it, and other means than ships are demanded. England's shipping is twelve times that of France, twenty-six times that of Russia, seven times that of Germany, and sixteen times that of Italy. Her dependencies, or colonies, stretch around the world, yet her naval expenditure compared to her sea-carried commerce is not one fourth as much as other European powers. Russia and France spend $50 for each ton of their foreign shipping, and England $7.50, so that the required naval expenditure is not in proportion to commerce, but to match the possible opposing power in case of war.

No. 82. MAY, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.

WASHBURN & MOEN M'F'G. CO.

WORKS:

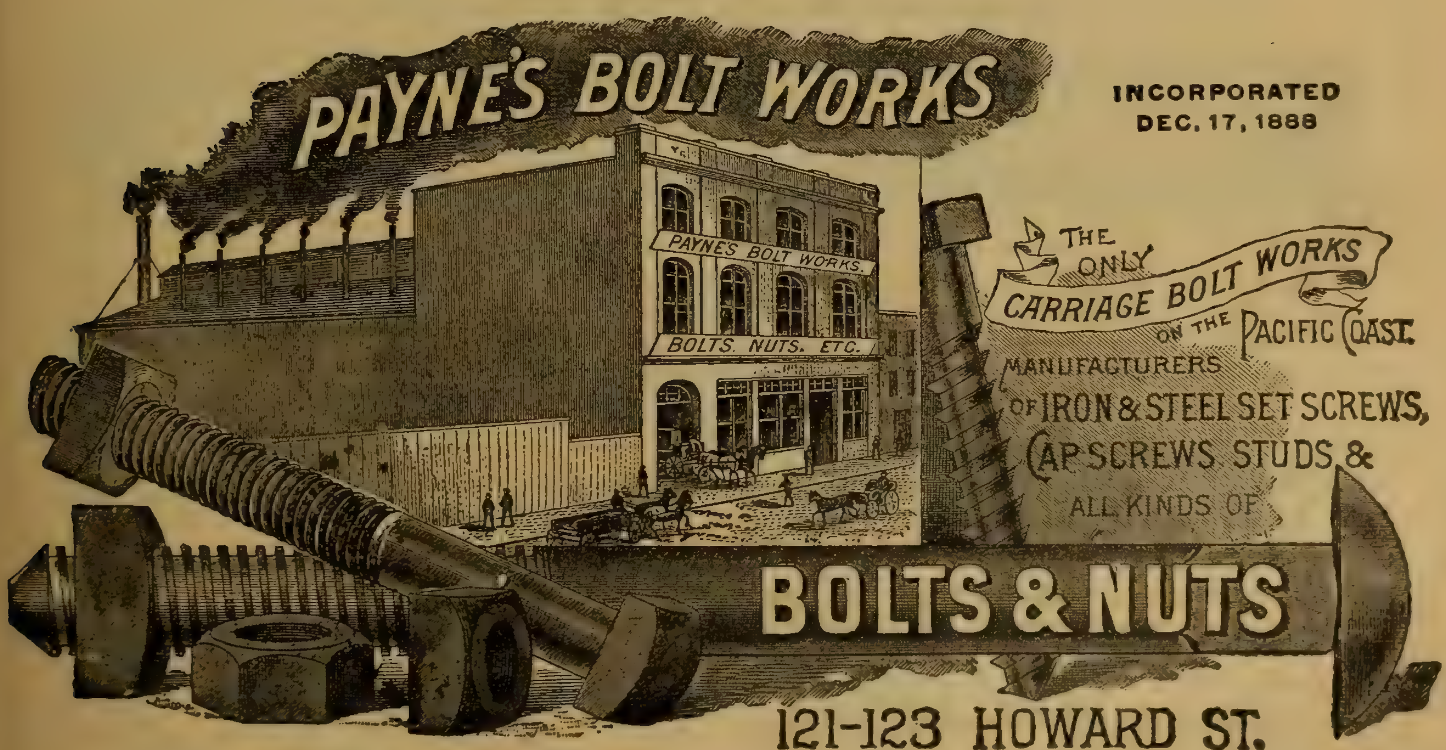
WORCESTER, MASS. WAUKEGAN, ILL.

BARBED WIRE.
BALE TIES.
WIRE ROPE.

IRON AND COPPER
BARE AND INSULATED
ELECTRICAL WIRES.
WIRE SPRINGS.

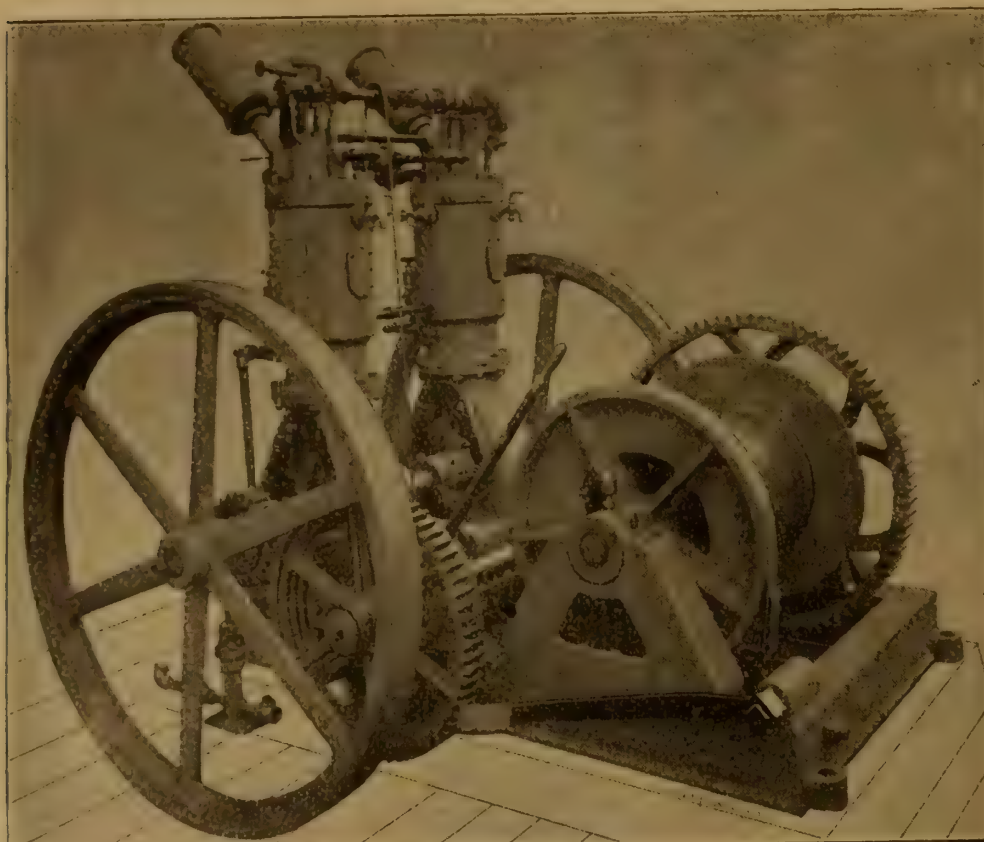
SAN FRANCISCO OFFICE AND WAREHOUSE: **8 and 10 Pine Street.**

FRANK L. BROWN, Pacific Coast Agent.



Upset Bridge Rods, Truss Rods and Anchors, Turnbuckles, Head and Point Drift Bolts, Wine Cask Bolts with Brass Acorn Nuts, Cold Punched Square and Hexagon Nuts.

All Kinds of General and Special Blacksmithing



The
"Golden
Gate"
Gas
Engine

is not a new comer, but has not been advertised in the papers as some others, but if you are in need of a Gas Engine, just ask anyone who ever had anything to do with them, and they will tell you:

"Get the Golden Gate."

Uses Gas or Gasoline.

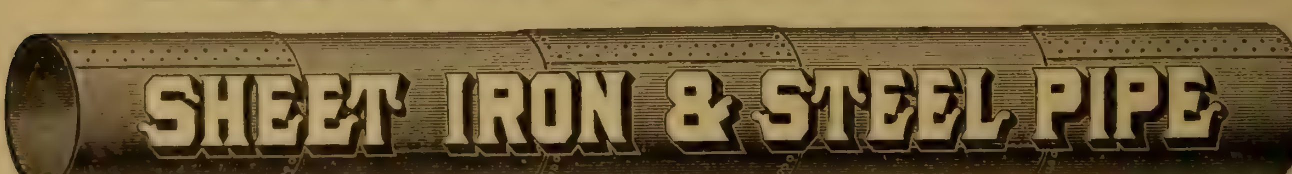
Made and Sold by

ADAM SCHILLING & SONS

211-213 Main Street, San Francisco.

The "GOLDEN GATE" is made strictly according to its own Letters Patent issued.

FRANCIS SMITH & CO.



130 BEALE STREET, SAN FRANCISCO

☞ Iron cut, punched and formed, for making pipe on ground where required. All kinds of Tools for making Pipe. Estimates given when required. Are prepared for coating all sizes of pipes with a composition of asphaltum.

MEDAL—WORLD'S COLUMBIAN EXPOSITION—1893.

JESSOP'S STEEL

BEST

ENGLISH TOOL STEEL

FOR TOOLS, DRILLS, DIES, etc.

JESSOP'S STEEL

ALL KINDS IN STOCK

WM. JESSOP & SONS, Limited. Works: Sheffield, England

W. F. WAGNER, Manager, Chief American Office, 91 JOHN ST., N. Y.

I. WILLARD BEAM

SOLE AGENT FOR PACIFIC COAST

29 Main Street, San Francisco, Cal.

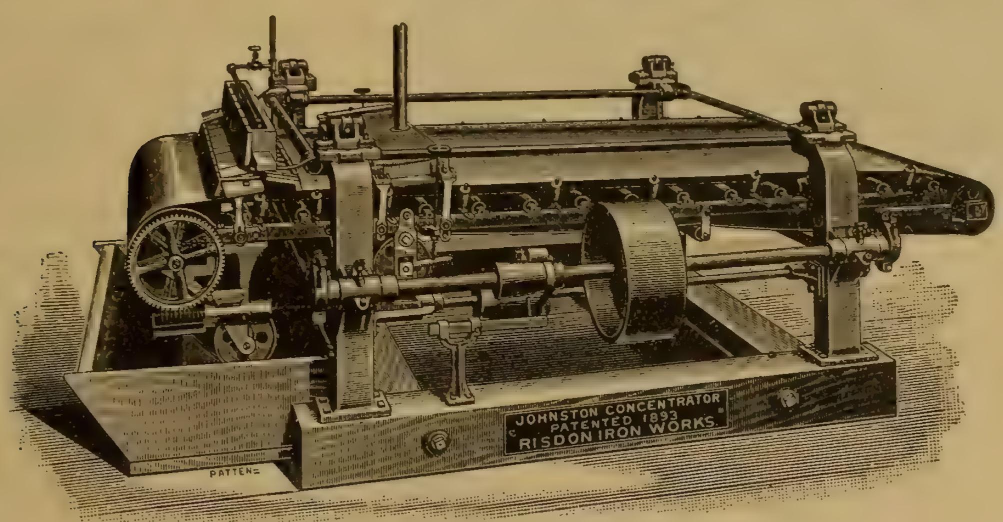
JESSOP'S STEEL

Risdon Iron Works

Cable Address: "RISDONS."

BEALE and HOWARD STS., SAN FRANCISCO.

JOHNSTON CONCENTRATORS



Simplicity of Construction **Great Durability** **Ease of Operation**
Increased Percentage of Sulphurets Saved

AWARDED FIRST PRIZE AT MIDWINTER FAIR, FOR CONCENTRATORS, PUMPS, BOILERS, AND BALL ENGINES

WHAT USERS OF THE JOHNSTON CONCENTRATORS SAY:

THE HUDSON GOLD MINING CO.,
WARD, COLORADO, June 8th, 1894.

THE RISDON IRON WORKS,
SAN FRANCISCO.

GENTLEMEN:—After a thorough test of the Johnston Concentrator, I am so well satisfied, that I wired you to ship me two more, as speedily as possible. I find the machine well constructed, easily kept in order, requiring but little attention, and doing entirely satisfactory work on our ore. After my experience with other tables, I am congratulating myself on my possession of the Johnston.

Yours faithfully, B. LANGRIDGE, Ph.D., Mining Engineer.

THE RISDON IRON WORKS, SAN FRANCISCO, CAL., June 1st, 1894.
SAN FRANCISCO.

GENTLEMEN:—We have tested the Johnston Concentrator furnished us by you on trial, and, after an exhaustive trial, we are satisfied it is the best in the market. Please prepare and ship us, as soon as possible, thirteen more machines.

Yours truly, APOLLO CONS MINING CO.
By LEON SLOSS.

WE ARE AGENTS FOR

Heine Boilers.
Ball Automatic Engines, for Pacific Coast.
Improved Wheelock Engine,
With Hill Valve Gear.
Conover Condensers.
Webster's Vacuum Heaters and Purifiers
Baragwanath Feed-Water Heaters.
Davidson and Marsh Steam Pumps.
Smith-Vaile Duplex Pumps.
Centrifugal and Triplex Pumps.
Phillips' Metallic Packing.
Matheson Lock-Joint Pipe.
Hydrants, Gate Valves,
Pressure Reducers, etc.

SEND FOR CIRCULARS AND PRICES.

"INDUSTRY."

JOHN RICHARDS, Editor.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

SAN FRANCISCO.

FOUNDED 1888. MAY, 1895. No. 82

MANUFACTURES ON THE PACIFIC COAST.

Can manufactures be built up and maintained on this Coast? is a problem now considered by the people of this City and the State.

One answer to this is that manufactures are now built up in many lines, and are locally patronized and sustained to a greater degree than in any other part of the United States.

Among these can be named, cable railway construction, heavy pumping machinery, centrifugal and other, steam boilers, elevators and hoisting apparatus of all kinds, gas and petroleum engines, tangential water wheels, portable engines, harvesting machinery, explosives, electric motors, dredging machinery, and many other things, not to mention the great fact of constructing vessels of war by the Union Iron Works, and in many other branches of industry with which we are less familiar.

Now these things are, as before said, locally made to a greater extent than in any other city or State in the Union, but the circumstances of isolation, natural resources and a laudable ambition, demands that the trade be extended and rendered nearly exclusive. To this end has been formed the Manufacturers' Association.

This society, now permanently organized, has elected Mr. Henry T. Scott, president; L. R. Mead, secretary; and A. Sbarboro, treasurer, with co-operating officers among our prominent manufacturers. Also have organized committees on Legislation, Grievance, Promotion,

Transportation, Finance, Publication and Municipal Buildings. This seems a fair and methodical start, with the well wishes of all the various interests concerned, and much good can be done if co-operative effort is maintained.

The problem to be dealt with resolves itself into two parts. One represented by the matters enumerated above in the list of committees, the other in the nature of products here and their relation in quality and price to those of the Eastern States or other places from where supplies are drawn.

It is to this second branch of conditions that the present article will be addressed. Especially, administration methods and processes in works, to which the efforts of "INDUSTRY" has been especially directed for eight years past.

It is a most thankless and unpopular labor. One may consult with and advise a manufacturer in respect to buying, selling, shipping, markets, advertising, and so on, with impunity, but as soon as the implements and management of his works are mentioned there is instant resentment. If for example, one should go into one of our machine works and tell the owner he should pickle his castings, paint his machinery with lusterless paint, use standard gauges for sizes, and do his boring with bars, he would invite even a committee, to attend to their own business. But all these things, which are mentioned in illustration only, are direct elements of cost and value in machine work, that not only cost nothing, but less than nothing, because they cheapen the cost of work and increase its value. Moreover, are among the means employed by competing firms to detract from and supplant our local manufactures.

As remarked, it is to these and other like technical matters of an unpopular kind the efforts of "INDUSTRY" have been directed, and it is in this intrusive field we will be compelled to labor in future, believing no higher aid can be rendered the object of the Manufacturers' Association than in this manner.

In such a position there is no assumption of superior knowledge, but to continually maintain a digest from observation of practice and progress the world over, gathered from connections in the East and abroad, and from nearly a hundred exchanges coming from all parts of the industrial world.

Further speaking of the Magazine, it may be confidently claimed that no progress or improvement of importance in the technical arts has escaped notice during eight years past, and that their value and adaptation here have in nearly all cases been successfully foretold.

In none of the manufactures named, and in many more that could be named, has the field been held by natural advantages, except those of being on the ground. The cost of transportation, which is often mentioned, and should naturally give a large margin of advantage to Coast manufacturers, does not do so, when the whole business is considered. What is gained on material is to a great extent lost again in sending out products, because of differential rates from the East into the zone of trade naturally belonging to this Coast.

The main thing has been skill, and by keeping in the lead. The price of success at this day is a bold vigilance. The rule is the "survival of the fittest"—a struggle for existence. Sentiment goes for little. People buy where their interests are best served, always will do so, and any policy or action not based on this fact must fail or lack permanence.

With a tolerably wide experience in various parts of the world, we maintain that in constructive engineering, there is no place with such fertility and boldness of ideas, or more technical knowledge to confirm what is good and reject what is bad, as here in San Francisco. There is nothing chimerical in the sanguine expressions heard in the speeches at the Manufacturers' Convention. There is possibility of all that has been claimed.

Dear fuel is not a bar, besides is unnecessary, as we can hope to see when the methods and profits of mining, handling and transporting coal are reduced to the standard that exists elsewhere. Iron is now no dearer here than in New York or Philadelphia, if we had a free port and no customs tax, which at the present time, like the duty on coal, is a direct discrimination against this Coast. All other minerals, and timber of extraordinary quality there is at hand. Food, house rent, and even clothing, are cheaper than in the Eastern States. The whole rests in energy, confidence and skill, the latter term including competent administration or management of works and the economies that depend on such management.

The cost of labor, which is continually set forth as a bar to successful manufacturing here, is one of the most flexible elements of all, that always adjusts itself to circumstances. No man not a fool will demand money for his work not earned thereby, after leaving a reasonable profit to his employer, and as a matter of fact men do not strike or complain unless they believe that the effect of their labor is producing fairly what they demand.

We do not claim that this is the fact, but that workmen do not know, under the present system of wages, prices and profits, what

their wages can or cannot be, and here comes the very foundation on which the high wages on this Coast are based, that of irregular prices and profits, on an average too small, perhaps, but unfixed and speculative in many branches, not only in manufactures, but in trade as well. This is an inheritage from early times, fast passing away.

Coming now to a practical matter that may well illustrate our present contention, we will allude to a subject that has for six years past been constantly urged in "INDUSTRY." That of impulse steam engines, and their introduction on this Coast. It is a matter in every way corelative with the present interest in skilled manufactures, and is urgent in every way.

Indications at the East show that attention there is drifting to this matter, and unless at once taken up here, we will soon be importing such engines, and then begin a "stern chase" among a labyrinth of patents and forestalled inventions.

There is now a strong aptitude in the direction of steam apparatus, but the main commercial reason for beginning and following impulse steam engines is their adaptation to local wants and circumstances. Nowhere else in the world, in proportion to population, are there so many steam engines employed, or for such diverse purposes, and especially to small purposes, where the skill and attention required for reciprocating engines cannot be afforded.

Having recently gone over the facts in a general way in the January number of "INDUSTRY," it will not be necessary to again explain what impulse engines are, or how made, but to predict that an early and persistent development of the manufacture here at this time would perhaps add as much to the industrial interests of this Coast as months of effort on the part of the Manufacturers' Association. There are at this time not less than 20,000 horse power of these engines at work. Their economy has overtaken and bids fair to surpass the ponderous reciprocating engine, at a third of its cost, all of which was predicted in "INDUSTRY" seven years ago.

In a letter lying at hand, just received from an eminent engineer in Europe, are these words: "I expect to live to see the time when reciprocating steam engines will for most purposes be relegated to the scrap heap." These words are not written by an enthusiast, but by an old conservative engineer of the highest standing.

This is but one thing, others are coming all the time, and the secret of success is to be early in the race and first to occupy the ground. In this work it is our province to assist, and with an abiding faith "INDUSTRY" will contribute its share in the work to be promoted by the Manufacturers' Association.

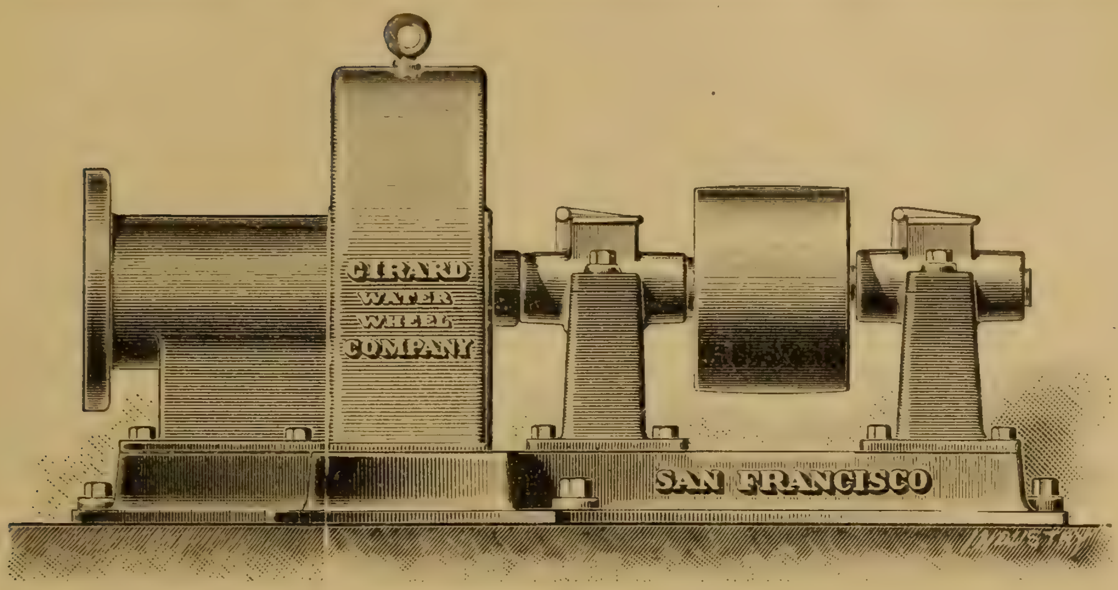


FIG. 1. SIDE ELEVATION.

THE GIRARD WATER WHEEL COMPANY.

SAN FRANCISCO.

We are glad to announce in the midst of an unusual interest in the matter of local industry in this City the founding of a new and important branch of engineering work, that of making Girard impulse water wheels. It is a branch of much importance from several points of view, which may be briefly considered.

In the first place the American people, contrary to custom and tradition, have almost without notice or participation, permitted the rise and development of impulse turbine wheels to go on increasing for forty years past in nearly all the countries of Europe; the only exception, and a very important one, being the development and manufacture of tangential wheels on this Coast.

The impulse turbine was invented in this country long prior to its rise in Europe, but the inventor in presenting his petition for a patent in the United States Patent Office in 1853 for an unfilled or impulse turbine water wheel was informed that he had no standing in hydraulic practice, and his views were fallacious. The fact of his having constructed such wheels, and operated them under high efficiency, was not, for some strange reason, regarded as good evidence, but twenty or more years later, after Girard and others had demonstrated the value of the method, and certain firms in Europe were engaged in making and supplying such wheels, a patent was issued to Mr. Jearum Atkins, now an invalid, over eighty years old, in the "Old Man's Home," in Philadelphia, Pa.

There the matter rested in this country. The Fourneyron and Jonval wheels were introduced from France, and the American inward discharge turbines came up in many ingenious forms, but no wheels operating on the impulse system, except tangential wheels in California, and when the Niagara Commission came to consider water wheels for a head of 140 feet there were no plans furnished from this country that met with any consideration by the commission of engineers appointed for that purpose, except the tender for tangential wheels prepared by the Pelton Water Wheel Co., of this City. The reason of this is found in the fact that all over the Eastern slope, from the Rocky Mountains to the Atlantic Coast, and

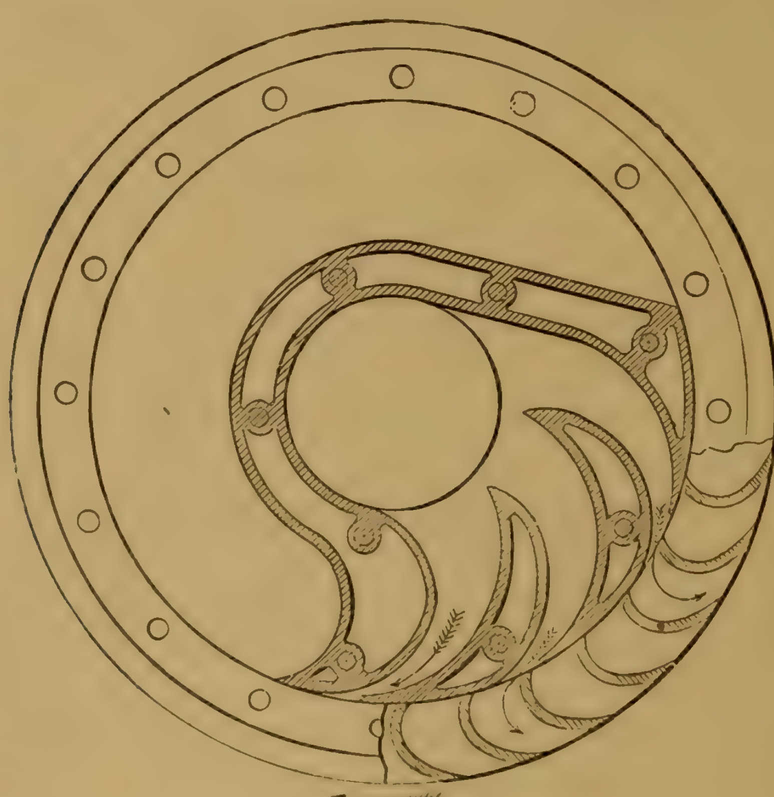


FIG. 2.

GIRARD WATER WHEEL CO., SAN FRANCISCO.

Diagram showing the method of applying the water on Girard Wheels.

throughout the Mississippi Valley, where nearly the whole of our industries and population are situated, the streams are flat and the heads are low. Where this is not the case the volume of water is usually great, and the head is divided, in some cases into three parts, so that turbine practice has all centered in the pressure or low-head type now made by not less than twenty firms and companies in this country.

The Girard or impulse water wheels, so called because M. Girard, of Paris, was most prominent in developing, explaining and designing such wheels, came to the front about 1860, being first made, but on plans now abandoned, at Zurich, in Switzerland, where, as on this Coast, the high heads and pressures rendered the common turbine wheels impracticable.

Girard or impulse water wheels as distinguished from pressure turbines, and even from tangential or other impulse wheels, have peculiar features. They are capable of regulation as to speed and capacity without loss of water, and will operate with the same efficiency under great changes of load and quantity of water applied, also are capable of receiving a large volume of water on a small

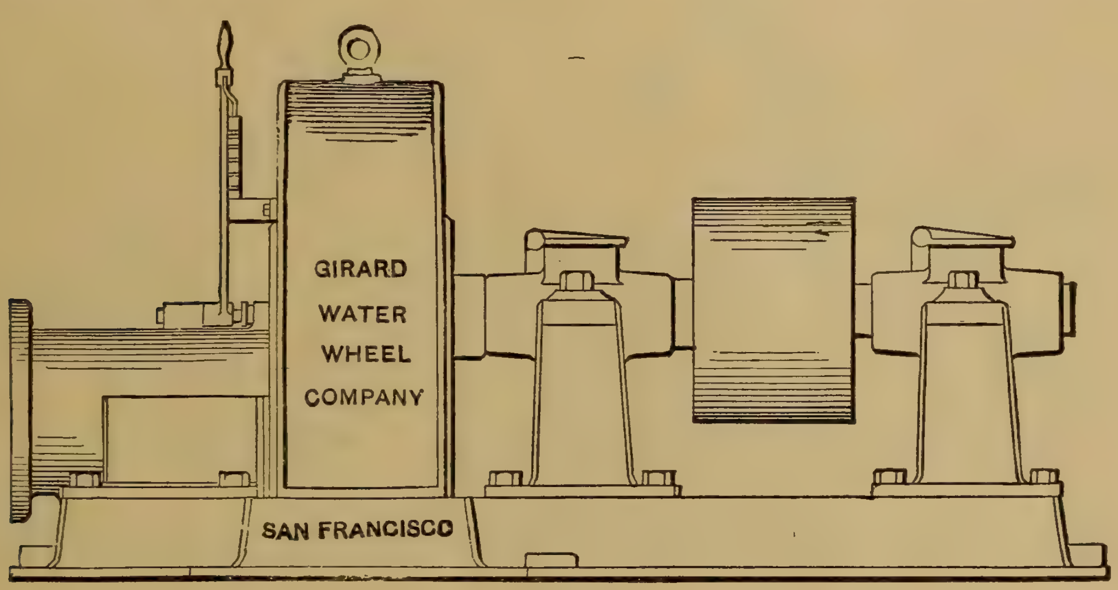


FIG. 3.

PLAIN GIRARD WATER WHEEL.

(Register Control.)

GIRARD WATER WHEEL CO., SAN FRANCISCO.

These wheels have from two to ten issues or jets. The number in use is varied by the handle at the side. A sector shows the number of issues open and closed.

wheel, so the speed of revolution can be made to suit any case without gearing. The issues or nozzles can be of any number, from one to a dozen or more, and, in regulating, these issues are entirely cut out, or their area changed, so that all the water applied on the wheel meets the vanes at full head and pressure. Throttling the water supply and diminishing the pressure is not necessary, and this is a very important matter, because the speed of a water wheel being

as the head or pressure, throttling the water with any kind of a valve in the supply pipe, lowers the pressure, changes the relative velocity of the wheel and water, and efficiency rapidly falls off.

The water is applied on the interior of the wheels, and passes out radially through the rim assisted by centrifugal force, and falls clear of the running elements. The efficiency need not be a matter of discussion, any competent engineer capable of analyzing the nature of forces, and with some knowledge of hydraulics, can easily compute the efficiency of water applied on this method, even if the fact of an extended use dating back forty years was not enough to settle this point. No other type of water wheels can give

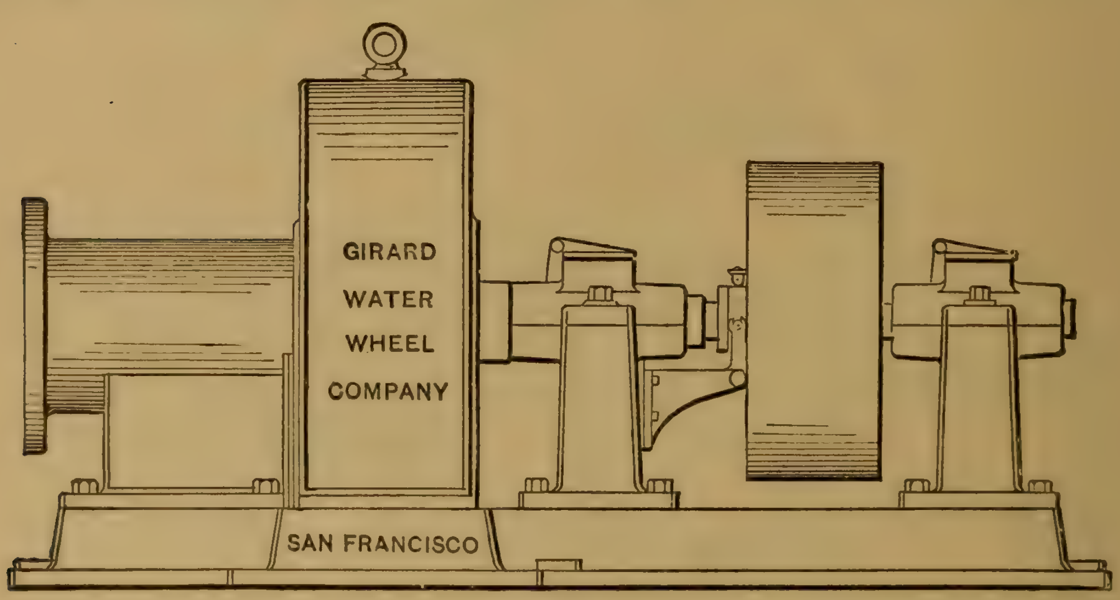


FIG. 4.

GIRARD WATER WHEEL WITH INERTIA GOVERNOR.

(Regulation by Variable Nozzles.)

GIRARD WATER WHEEL CO., SAN FRANCISCO.

Two to five hundred horse power.—— One to three nozzles or jets.—— Size of issues varied by the governor.—— Absolutely no waste of water.

out more power with a given amount of water under heads from 20 to 2,000 feet. The diagram, Fig. 2, shows the manner of applying the water, and the curves indicate its course through the wheels.

The automatic governors employed by the Girard Water Wheel Company to control the regulating apparatus are much more complete than any that have been applied in Europe. They operate on what is commonly called the "inertia system," not by both momentum and inertia, as in the case of steam engine governors, but by the

inertia of the driven machinery communicated through the driving pulley and opposed by centrifugal weights, so the whole power of the wheel is communicated *through the governor.* This is an intricate matter not easy to explain without drawings, and difficult even then. The most marked feature is that the governor will at its neutral or normal position, where common governors have but little effect, exert full force either way for minute changes.

For low heads, from 20 to 50 feet, the water can be applied all around the wheels if required, because one nozzle or issue does not interfere with another, and they can be placed nearly together, being separated by thin guide vanes only.

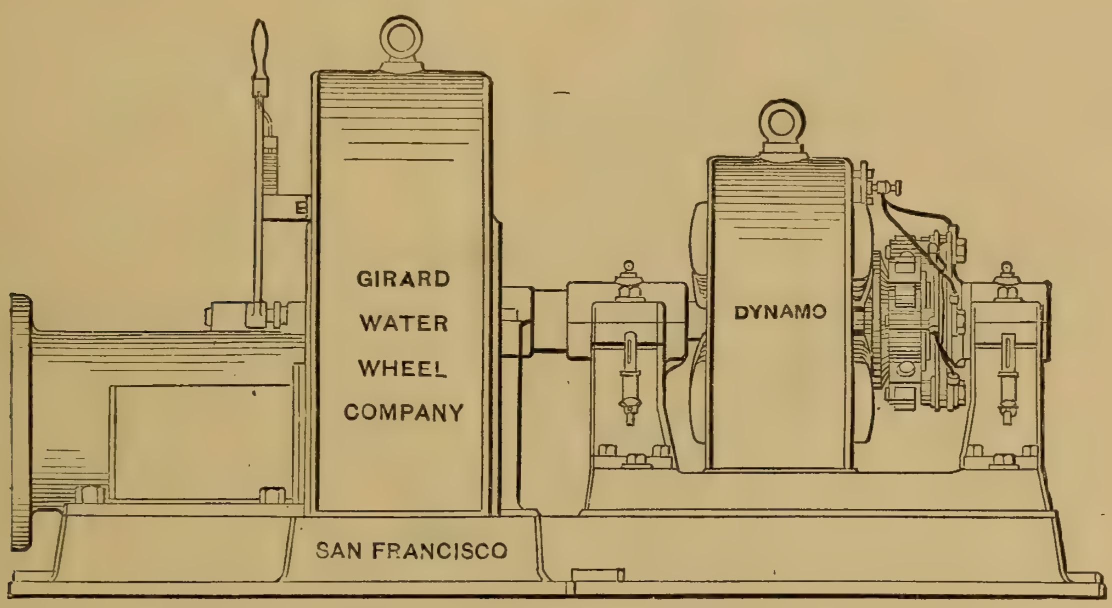


FIG. 5.

GIRARD WATER WHEEL AND DYNAMO COMBINED.

GIRARD WATER WHEEL CO., SAN FRANCISCO.

Register gate, two to twelve issues or nozzles.——Dynamos bipolar or multipolar.——Compound wound, one to five hundred kilowatts.——Wheels adapted for heads from 40 to 800 feet.

In our remarks at the beginning in respect to impulse water wheels in this country we should have included or mentioned the late practice of Emile Guyelin, C. E., of Philadelphia, representing the Jonval water wheels in the United States and throughout America.

We have received from M. Guyelin, as noted in a late issue of "INDUSTRY," elevations of the late plant designed by him and now in use at Niagara Falls under a head of 140 feet. The Fourneyron

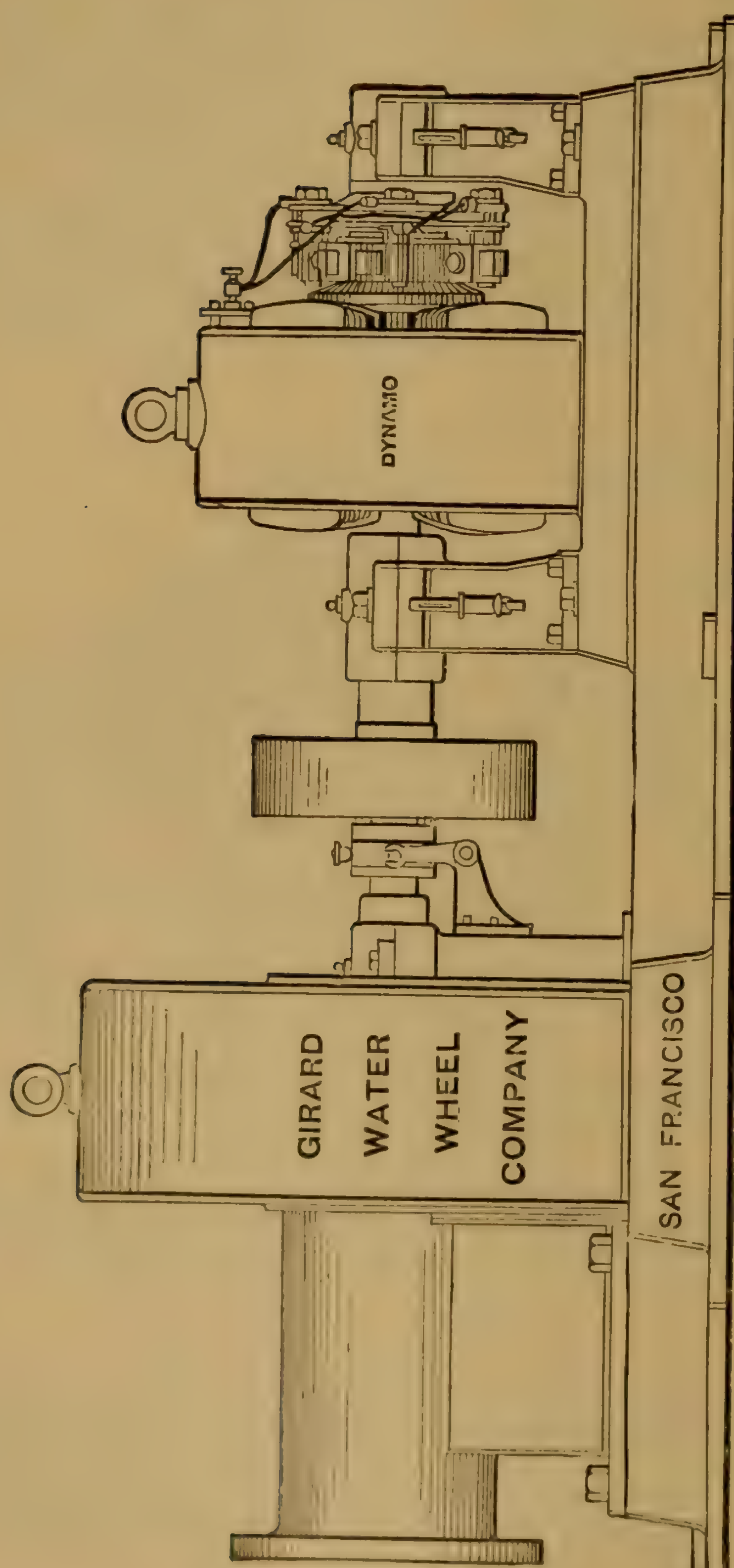


FIG. 6.

GIRARD WATER WHEEL AND MULTIPOLAR DYNAMO.

GIRARD WATER WHEEL CO., SAN FRANCISCO.

Inertia governor and variable issues.—One to three jets, one or all variable.—No waste of water with varying loads.—Made from five to five hundred horse power.

type of wheels for the main plant, that of the Niagara Falls Company, were made from designs supplied by Messrs. Faesch & Picard, of Geneva, Switzerland. The Guyelin-Jonval wheels were contracted for subsequently, but are the first at work, and have been running for nearly a year past.

The Jonval, as a pressure turbine, in which class it is supposed to belong, is readily adapted to operate as an impulse or unfilled wheel. We are not able from drawings at hand, received from M. Guyelin, to determine how far his plans involve impulsive action, but of one thing we are quite sure, the general design is superior to that of Messrs. Faesch & Picard. We think it proper to mention this matter in fairness, and also must claim that since the time of Atkins' invention, forty years ago, these new wheels at Niagara Falls are almost the first examples in impulse water-wheel practice in this country, except the tangential type made on this Coast.

It is fitting therefore, and of infinite credit to this City, that the subject is taken up here in a manner that indicates thoroughness, and with improvements that peculiarly adapt the wheels for use on this Coast, that is, with economy of water and good regulation under high heads and small volumes.

The drawings herewith, Figures 1 to 6, and the notes below, especially the diagram Fig. 2, will explain very fully the nature of the wheels and the modifications proposed by the Girard Water Wheel Company, who are now executing some important orders for wheels of this kind, at their works, 34 and 36 Main Street.

OLD MASTER MECHANICS.*

Some years ago, twelve or more, I read in a Boston newspaper, called the *Journal of Commerce*, an article entitled "Mechanics of Forty Years Ago," and cut out a portion of this article for a scrap book. The following is an extract:

"Forty years ago there was no solid iron bed lathe, the best lathes were built on 'ways' of southern pine, into which were seated short sections of cast iron to form the seats and ways for heads and carriage. These were seated by means of grooves cut by hand planing, and held in place by wood screws passing through the casting into the solid yellow pine, almost as hard and enduring as the iron. These ways were shipped and filed to level, and then

*Extract from a lecture prepared by the Editor in 1882.

planed by hand, an ordinary jack plane being used to smooth the inequalities of the iron, and insure an even length. A block of wood grooved to the 'ways' was used to finish them by means of emery and oil, and lastly by water and moulding sand. Now this looks like boy play in the light of our admirable systems of planing, finishing, scraping and testing, but some very excellent work was done in the building of tools by these crude methods, and the tools themselves did satisfactory duty for years.

The first planer for iron was similar to that now in use, except for its improvements. Midway of a long table arose the 'head,' and this held a cross screw turned by a wrench and a down feed screw, also hand managed. Of course there was no automatic down feed or cross feed. At each end of the frame of heavy yellow pine timbers, reinforced with a rib of iron with a **V** section, was a roller of timber some ten or twelve inches in diameter, and this was driven by a belt one half the time of operation, and a similar one at the other end was driven at alternate half times. Each of these wooden rollers engaged with and 'took up' a heavy log chain that was connected with the platen.

The lathe was scarcely better as regarded usefullness and exactness. It was a much older tool, but it had never been improved. The cone pulleys of the head must be of mahogany, or of other close-grained wood, and must also be scored 'to hold the belt.' The first daring tool builders who cast of iron the graded pulleys of a lathe head found all the machinist world against them. It was certain that no belt could hold on a polished iron surface. It was settled that wood was the only proper material for the pulleys of a lathe. At that time, forty years ago, it would have been ridiculed if it was stated that a continuous screw should be used as a feed movement on lathes of more than six feet, and yet all our lathes now are screw feed, no matter what their length."

This matter is introduced here to show and explain the obstructive influence of conceit. There is no doubt that at that time, fifty years ago, which people can almost remember, the estimate set upon these tools and methods was much higher than is now placed upon the very perfect work done in New England in this same branch of industry. All know the wonderful advancement made there in machine tools, especially those applied to exact work and the lighter class of processes, and it will not be far wrong to assume for New England, and everywhere else, that the amount of real progress is inversely as the estimate placed upon it, or the amount of conceit that enters into such estimate.

At that time, 1844, the improvements in machines and implements were in a comparatively advanced state in European countries, especially in England, so much so that no very fundamental improvements have been made since then in what are called the standard

machines for turning, planing, drilling and boring metal, as will be shown farther on.

This assumption is based upon facts gathered some years ago when it was necessary to trace the origin and progress of machine tools in a historical way, and when the facilities were at command. The notes made then, twenty years ago, had reference to litigation over patented inventions, and have been lost or mislaid. What is reproduced here is mainly from memory and some memoranda made ten years later. The purpose of its reproduction will appear at the end of the remarks, saying here, however, that the object is not to satisfy curiosity so much as to draw useful conclusions that may be of considerable value.

All human actions spring from incentives, the satisfaction of desires, and when there is no incentive there is no action. When people are satisfied with what they already have, and believe that no one else has more, progress ceases. Without the least disrepect to one of the most worthy nations in Europe, the Dutch can be referred to as an example. Once they occupied a foremost place in the mechanic arts and invented many important things long before their use by other nations, notably compound steam engines, circular saws, and many kinds of hydraulic apparatus, but now they have little of these arts in their country, owing no doubt to the want of natural facilities, such as fuel, iron and timber, but also from a conceit that their countrymen are "waiting for other people to catch up."

It is told in England that some years ago when there was agitation concerning a reform or improvement of the Patent Laws, the representatives of various countries in London were applied to respecting the nature and operation of patent laws in their respective countries, and for facts and suggestions in respect to laws regulating inventions.

The Minister of the Netherlands replied to this inquiry that Holland had no patent laws, and that none were required there now, that in times past when the mechanic arts were crude, and technical education was wanting, patents were required to promote inventions, but now no such a thing was required, and the progress of his countrymen was such that the circumstances of other countries did not apply to Holland. In support of such an opinion it must be remembered that this remark would two hundred years ago have contained much truth, also that some of the grounds on which patent laws were abrogated in Holland are not easy to controvert.

I need not waste time in speaking of the Chinese nation and their assumption of superiority over the western barbarian. Their

conceit is founded upon a good deal that is defensible in civic affairs, but is evidently at fault in respect to all modern arts.

The best way, or indeed the only way, to avoid mistaken opinions respecting what we can do or know is to become aware of what others know and can do, so as to make fair comparison. Hence there is a useful purpose in comparing industries and their progress at various periods and in various countries.

In this country we are peculiarly situated respecting the causes that go to make up an estimate of our progress. We are 3,000 miles or more from any other country with a similar civilization. We are almost without the spur of emulation. Our commercial policy is such as to deprive us to a great extent of the advantage of imported examples, at least in the same degree that other countries enjoy that advantage. At the Centennial Exhibition of 1876, foreign exhibitors were not permitted to sell their exhibits, or rather our people were not permitted to buy them without paying a custom's premium of from twenty-five to fifty per cent. The result was that there were few if any machines or tools brought here from Europe.

The writer tried hard in 1876 to induce a Norwegian firm to bring to Philadelphia one of their wood-planing machines, and yet believes if this had been done it would have been of great value, not only to the makers of such machines in this country, but also to the users of planing machines, because it would have at once led to certain improvements now going on nearly twenty years later.

A strictly utilitarian view in these matters would confine our attention to the present and the future, but there is much to be gained by going over the past. The relative progress made in mechanic art by different people in the past when understood will go far to modify mistaken views respecting our time, besides there is connected with the development of skilled industry romance as interesting as can be found in other departments of human affairs. The manufacture of cast steel by Huntsman, the development of the steam engine by James Watt, and the steam hammer by Nasmyth, are stories of more interest to a mechanic than any based upon human passions or conquest. The literature of mechanics, so to speak, is scant at this time, but what there is of it is good and, what is better, is true.

The events connected with the wonderful development of skilled industry are not old enough to be moulded into myths. The "old masters" have not been long gone, their tracks are fresh, and their

lessons yet new. There is not much to be seen of the remarkable things in the way of old works, but some of them exist, and among all things that recall the past none that will compare with a visit to the private workshop of James Watt. Of this I will give some account now, although it does not come in the order of dates.

There is perhaps none here who do not know something of Watt's connection with the steam engine. Generally it is thought that he invented a separate condenser, centrifugal governor and some other details, but this is not all. The details he invented and applied are a very unimportant part of what he did. He developed the steam engine. Found it a toy, or experimental machine, and left it a staple article of manufacture, driving factories, lifting water from mines, and performing nearly all the varied duties we now see it applied to, railways and navigation excepted. He is the father of the steam engine, a claim fairly earned.

Out of Birmingham, three or four miles, is Soho, where Boulton & Watt's engine works were situated. They are there yet, and some excellent examples of both stationary and marine engines have been produced during late years by "James Watt & Co., of Soho."

Watt after conquering with his engine, and securing some pecuniary return for his labor, lived at Heathfield, a place containing about twenty acres of ground, near Handsworth, two miles or less from Soho. His old house is there yet, just as it was in 1819 when he died, except that some improvements and renovations have been made by its present holder, Mr. George Tangye, of Tangye Bros., Engineers, Birmingham.

In a wing of this old house, reached after various stairs and turnings, is James Watt's private workshop, where he worked and experimented after he had quit, or partially quit, the superintendence of the engine works at Soho. The room is a wonder. It contains more small tools than I ever before saw collected. There is an engine lathe with an outfit of implements that would number hundreds. Everything, even to the embers in the stove, are as Watt left them. His old pipe is there, a complete outfit of woodworking tools, and of small tools, perhaps a thousand pieces, every one of the neatest kind and in order, all placed in drawers, and such tools as reamers, taps, and the like, each wrapped in oiled paper. To me the greatest wonder was his carving or copying machine, on which he was engaged at the time of his death.

On this machine is a small figure, a human head, carved in wood by the machine from an original in ivory. This figure, scarcely an inch in diameter, is as perfect as its prototype. The

machine is a large affair, operating by rotary cutters, and with its attachments capable of copying pieces of some size, perhaps a foot or more in length or width.

Since seeing this machine I have been at some loss to account for the patents subsequently granted for copying machines, such as are employed in making shoe lasts, gun stocks, or other pieces of irregular figure. The principle in all is the same, even the mode of operation is analogous in all machines of the class, and in respect to Watt's machine I must say after seeing nearly all the most prominent copying or pantograph machines, that his is as complete as any of them. Those with which we are most familiar, such as spoke-turning machines, were understood by Bentham and described by him in 1793. Of this some farther mention will be made in a future place.

At the outside of the door to Watt's room, as it is called, there is a small circular shelf, on which it was the custom to set his midday meal. He never quit his work for luncheon, nor would he permit it to be brought into his room. The instructions were to set the food on the shelf, and rap on the door. If he wanted the luncheon he would eat it, if not it remained until evening.

To us it appears a long time since Watt passed away, but there in Soho it seems only a few months or years ago. People there do not estimate time as we do. The traditions and familiar facts repecting Watt and Boulton are as fresh and well known as they were five years after his death.

Passing through the works of James Watt & Co., in 1878, I found several matters of interest, one an ancient engine of the "grasshopper" type attended by an old man. I inquired if the engine worked well. He said: "Yes, it gave no trouble, new brasses were put in about forty years ago, and except that he did not know that the engine had stopped for repairs in sixty years."

I have seen an engine made by Boulton & Watt after eighty years of service. It was replaced by a new one about five years ago. At least three other engines of the same date are in use, one of them in Charleston, South Carolina. The one first referred to was erected under Watt's personal supervision at Bun Hill, in London, in a brewery. It had the sun and planet wheels, the main shaft making two revolutions for each double stroke of the piston. There was on the engine an engraved plate of brass, giving the date of erection and other particulars, such as the dates the engine has been repaired.

(To be continued.)

WM. B. BEMENT.

In another part of the present issue we treat on "Old Masters in Mechanics," but the masters whose influence is now around us and make our position in the world as constructors, are the immediate, or recent masters who have passed beyond the routine of common practice, and set up a new standard in our time and for a generation to come. Notable among the "masters" of our day who have widely affected practice, is W. B. Bement, now nearing the four score mark in years, and whose name, if not known to every mechanic in this country, is known in every works of any size in this and other countries. His portrait above, reproduced from a photograph, will be an object of interest to our readers. It is truthful, and as we have always thought, conveys a full idea of Mr. Bement's powers, traits and character.

Of his contributions to constructive engineering work in this country we need say nothing. Its extent is well known, but it will be proper to point out that when the methods of the Industrial Works were fixed thirty-five years ago, it was in an environment and state of the art that only the older mechanics can now recall. We had not then reached in any branch of work the quality now common in all, so the Industrial Works were founded on original lines. The firm, now Bement, Miles & Co., was then Bement & Dougherty, composed of W. B. Bement and James Dougherty, whose name can be worthily linked with that of Mr. Bement. Mr. Dougherty, when the firm was founded, stood easily at the head of foundrymen in this country. His education and abilities had led to his connection with Winans & Harrison in the construction of the Moscow and St. Petersburg Railway in Russia, and he had also been in some capacity, not now remembered, engaged in the Royal Foundry in Vienna, Austria.

Mr. Dougherty introduced loam moulding, and produced without patterns and without inherent strains the main frames for machine tools designed by Mr. Bement. The building of these moulds from figured dimensions was a work of great intricacy and skill that contributed much to the reputation of the Industrial Works. We can well remember his white canvas cap, which could be seen making its course all over the foundry at certain hours each day, and whenever some difficulty arose.

To Mr. Bement, who has no knowledge of this notice, the writer here makes acknowledgment of kindly counsel and instruction through many years, part of them spent in his service, and all of them with an admiration of his great powers as a designer and constructor.

The most marked feature of Mr. Bement was a kind of intuitive perception of machine functions and adaptation, that found expression in unusual skill of delineation and powers of description, the latter with but few words, sometimes no words at all. He would pass through the draughting room, the largest and finest one in this country, and from one desk to another, perhaps without a word, even if he saw blunders and faults, but he left an "impression" of approbation or dissent.

At the time we are speaking of, 1866 to 1876, the machine tool practice of this country was divided into two types or classes, that made in New England, and the Philadelphia type, the latter taking cognizance of practice all over the world, and consisting of original

designs, massive, well-fitted, plain in contour, and without ornament of either metal, paint, or burnishing; the New England type was, on the contrary, a "manufacture" at that time.

The difference, so great then, has to a great extent disappeared. Western or Middle State makers, now prominent in machine-tool making, copied the designs and characteristics of Philadelphia, especially Mr. Bement's work, and the methods in New England have changed greatly in the same direction since 1870, so the old position and relations of the Industrial Works, as before remarked, is hard to imagine at this time.

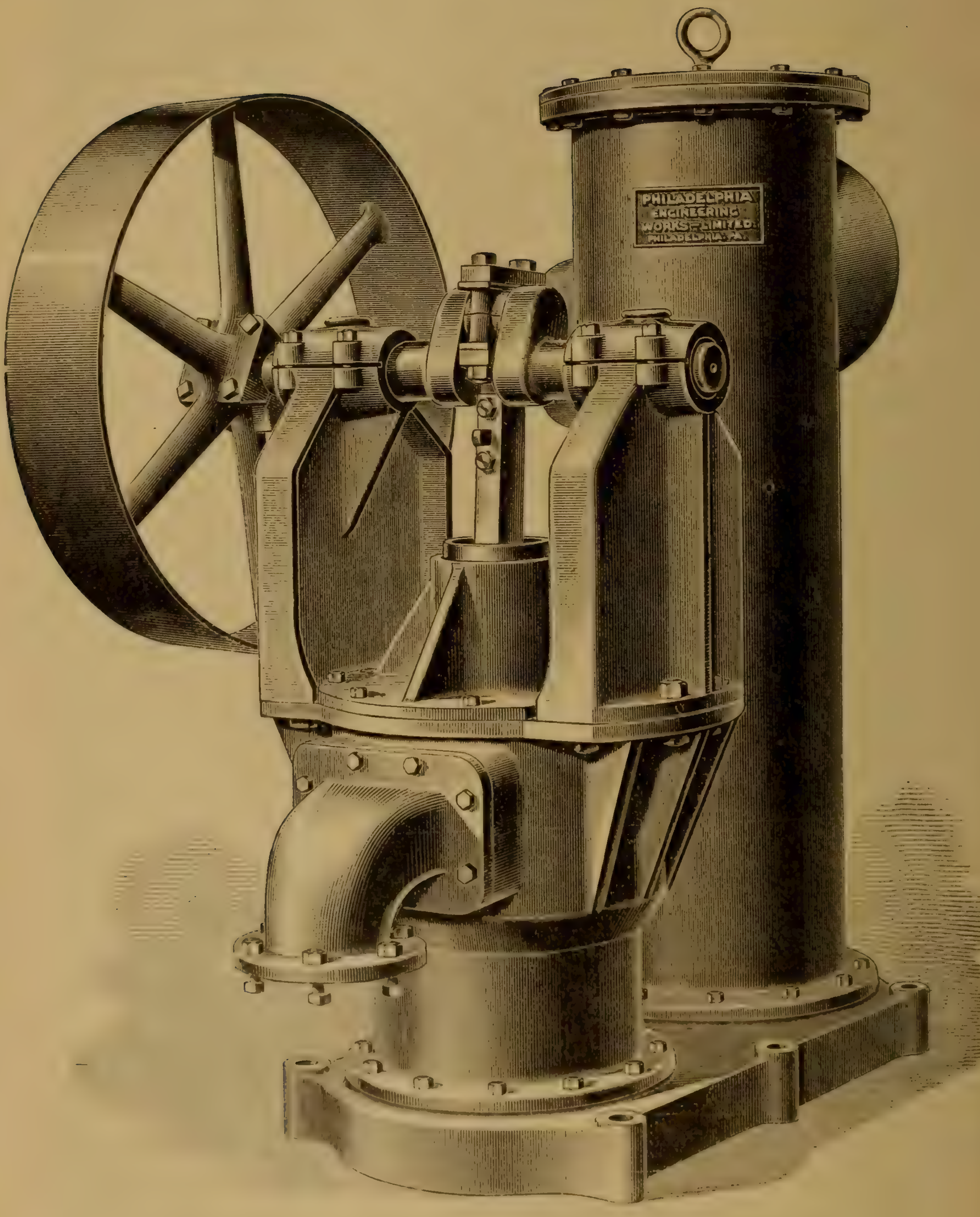
Mr. Bement in his early experience at the Lowell machine shop had the advantage of taking part in the hydraulic work of Boyden and Francis, and often told us of writing dimensions on the radii of fillets, so accurately were the drawings made. The Fourneyron water wheels, made there about 1850, all things considered, were the most scientific and advanced work that had ever been done in this country.

This and other circumstances gave Mr. Bement a bent toward accurate work, and he acquired a detestation of sham and bad fitting that always remained one of his strongest characteristics. The methods of drawing, pattern making, implements and inspection at the Industrial Works all savored of precision. "Make good work and ask a good price for it," was Mr. Bement's motto, and was the fixed policy of the business.

We have but little personal knowledge of the works for nearly twenty years past, but find in the products wherever met with sign and token of similar methods continued to this time.

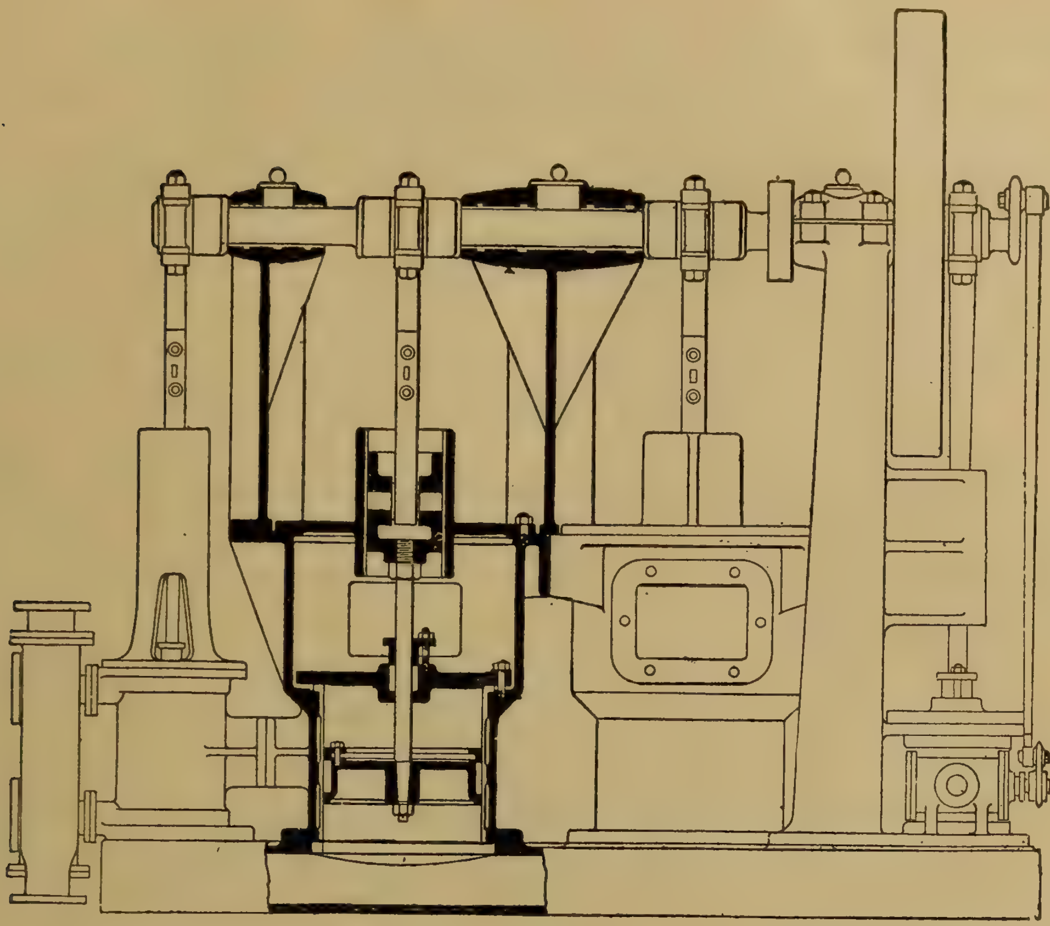
When Mr. Bement first visited Europe the reputation of his work was well known, and he received, in England especially, the courtesy due to his position at home. At the works of Messrs. Harvey, of Glasgow, makers of shipbuilding and other heavy machine tools, and among the noted firms at Manchester, he found counterparts of his own practice and a willingness to "exchange ideas." For many years exchanges were made of machine photographs with Messrs. Harvey and other firms.

About fifteen years ago Mr. Bement turned over his interest in the large works to his sons and others, and has since enjoyed a well-earned rest from active business. His work well and faithfully done goes on, and is a credit alike to himself and his country.



INDEPENDENT AIR PUMP AND CONDENSER.

PHILADELPHIA ENGINEERING CO., PHILADELPHIA, PA.



INDEPENDENT AIR PUMP AND CONDENSER.

PHILADELPHIA ENGINEERING CO., PHILADELPHIA, PA.

This country was late in establishing independent condensing apparatus as a "manufacture," but when commenced it has been carried out in a most complete manner, and with advantages of design and method that are as nearly perfect as can be imagined.

The latest designs are those of the Philadelphia Engineering Company, represented in the elevation of a belt-driven air pump and surface condenser on the opposite page, and in the section above, showing a double air pump and circulating pump, driven by a steam engine mounted integrally with the pumps.

The apparatus is made to suit the circumstance of use, for either surface or jet condensing, and for driving by a band from the main engine, or by an independent engine, so the business is hardly a manufacturing one, but a branch of steam engineering, involving, however, elements and details that the makers of steam engines cannot well combine with their regular business.

The surface condensers adopted and furnished with these machines are of the same type as those employed in the United

States naval vessels, a cylindrical shell filled with tubes, divided longitudinally into two parts, the circulating water passing first through one side and then the other, moving toward the incoming steam, so the highest temperature of the water meets the hottest steam, so that liquification is progressive and uniform throughout. Weights, capacity and other particulars have not been sent, but can be procured from the company at Philadelphia.

CHALK THE BOBBINS.

The phrase above, which almost everyone has heard, had a very interesting origin. It is an English-Lancashire story, told of Sir Robert Peel when he was only a cotton spinner, and before his Parliamentary career.

In those early times of cotton spinning one of the impediments was the filaments of cotton adhering to the bobbins. This "furze" continually built up until the tapes and bobbins had to be cleaned, consuming a good deal of time and adding much expense. Mr. Peel endeavored in every way to overcome this difficulty, which caused frequent derangement of the machinery, but without success.

It was noticed however that there was one man in the mills who never lost any time. His bobbins were always clean, and on Saturday evenings he always had full time, and drew his pay accordingly. The rest watched him to see how he managed to keep the bobbins clean, but failed to penetrate his secret.

Mr. Peel one day sent for him to come to the office, and inquired how it was he kept his bobbins clean. "Why," said the millman, "it is a koind of secret, Master Peel, and if I tell you, all the rest will use it." Mr. Peel told the man he would pay for the information, and asked what was demanded. The Lancashireman thought for a time and then demanded an extra quart of beer a day so long as he was in the mill. Mr. Peel at once agreed to this, when the man came up close and whispered "chalk the bobbins." That was the secret, nothing more. The white chalk he had been using was not noticed by the rest, it absorbed the oil or glutinous matter, and the fibre did not adhere to the surfaces.

The invention was patented, and machines invented for applying the chalk. The workman got his quart of beer a day, and was in due time pensioned by Mr. Peel, which was for the man far better than a sum of money down, which would have been his ruin, no doubt.

AUSTRALIA.

The Australasian Colonies, while a market distant in miles, is relatively a near one for this Coast, and has more to do with trade and prosperity here than is commonly known or supposed.

The timber trade alone is an important one, and the present depressed state of this industry here is in a great degree owing to the almost total suspension of the trade to Australia that existed three years ago.

The Australasian Colonies furnish the most singular among all examples of the protection system. It is near thirty years since Victoria set out to fix prices by law, and build up her interests as a colony by levying tribute on one part of her people to sustain the rest.

Twenty years of this policy, a part of the time under what we would call a "granger government," brought a great crisis, and to stave off financial disaster the country went to borrowing money and investing in public improvements, beginning with the Melbourne Exhibition and ending up two years ago with a wreck of credit and of all commercial and industrial interests, such as no English speaking people had seen before.

New South Wales was caught by the same idea, and about six years ago adopted a system of taxing her commerce; this lasted but a short time, however. Last year this method was reversed, and the financial system returned to its old base of nearly free-trading.

Now Victoria, having run the gamut, so to speak, of granger government, has repudiated the tariff tax system, and in a house of eighty-eight members returns but twenty-one of the protection adherents, a majority of fifty-four, not counting thirteen "independents," of which at least one half will vote to shift taxation to some source whereby it will not fall on consumption.

New Zealand's lesson has not been disregarded. There alone has there been peace and a freedom from financial throes that reached all other of the Australasian Colonies.

A sequence of this change in Victoria will undoubtedly be a renewal of the scheme for confederation, and in any case an almost immediate renewal of her trade, which will largely come here if we manage to reciprocate the policy that is almost certain to prevail hereafter in these colonies.

ELECTRICAL DENTAL APPARATUS.

PIEPER BROS., SAN JOSE, CAL.

Messrs. O. H. and A. F. Pieper, of San Jose, California, some years ago took up the subject of electrically-driven dental apparatus, and have pursued it through the usual course of "evolution" until the system or apparatus is now in a form to be "let alone," for a time at least.

The search for a motor or rather the modifications made to suit

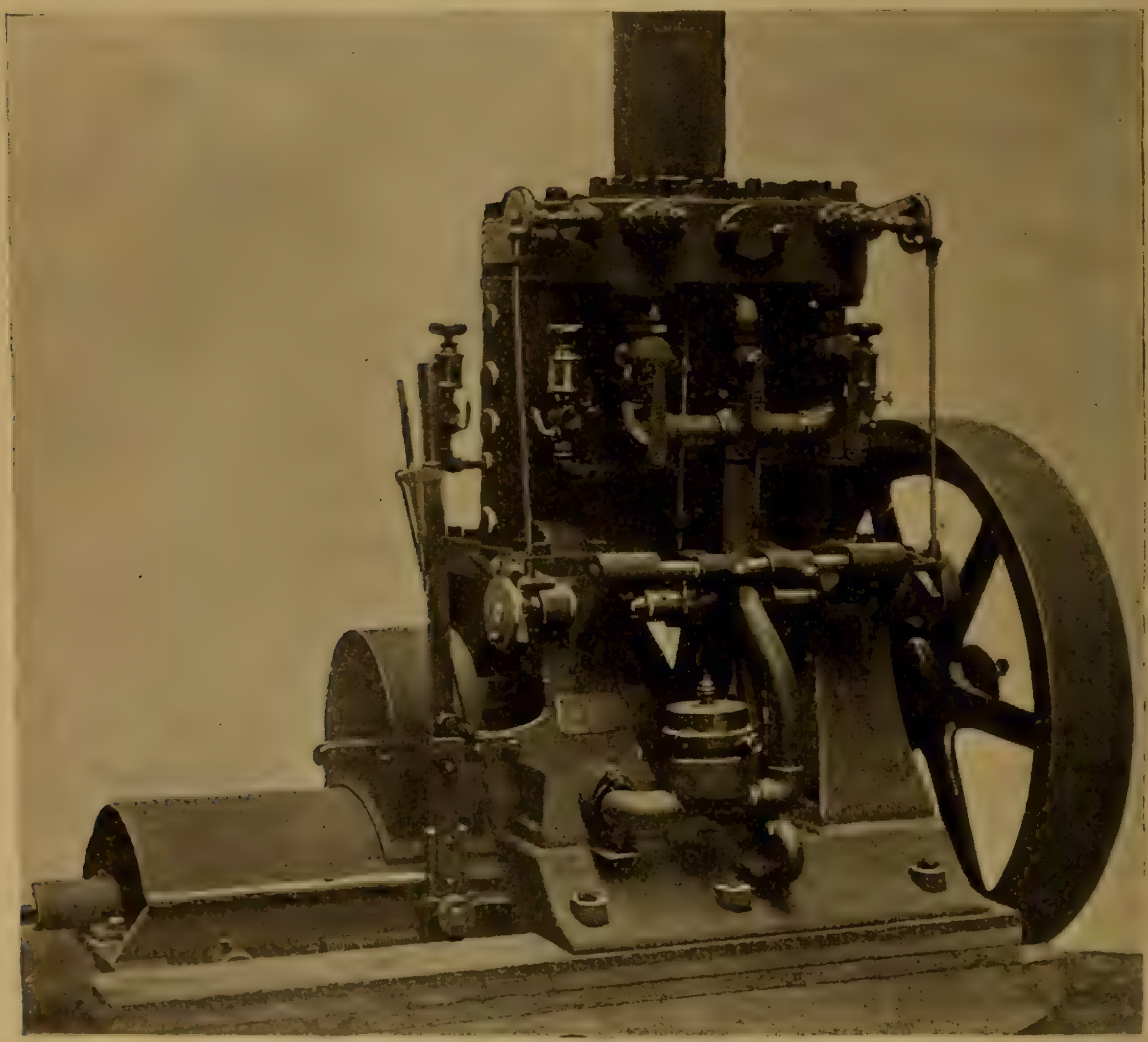
the particular requirements of operating dental implements, constituted a tedious part. The stopping, starting and reversing elements in the motor itself were no easy problem. Then followed the controlling devices or rheostats, and finally mechanical devices to sustain the motors, so as to permit instant adjustment to all positions, axial and lateral, and otherwise. But now, as before remarked, the whole matter seems to be completed.

The plate opposite shows the interior of a dentist's operating room with the chair and other appurtenances, including the electric motor, which is seen above suspended like a lamp bulb. All the parts are contained in the spherical case, mounted in a gymbal frame and suspended on a cable or cord, within which are the conducting and return wires, four in number. There are no visible wire pulleys or other apparatus, and no one in looking at the outfit would imagine it to embody machine motion. The flexible extension seen hanging below the motor contains the elements of transmission to dental implements of various kinds that are attached at the end.

The motor and its attachments are counterweighted, and can be instantly moved up or down, and swung in a horizontal plane by means of the hinged bracket on which the motor is suspended. Behind the chair on the floor is the controlling apparatus or rheostat, having a pedal that can be moved horizontally by the feet an operator, so as to run the motor in either direction at various rates of speed as the implements or nature of the operations may require.

The whole is a very ingenious example of both taste and mechanical scheming that does the inventors much credit. A number of patents have been granted on this apparatus. We are informed that its regular manufacture is now about to be founded in this City.

The latest feature in steam turbine practice, is to place one of these in connection with a common steam-engine, and pass the exhaust steam through the turbine to the condenser. Mr. Parsons, the principal maker of these impulse engines, has taken out a patent in England on the combination above named, and claims that the energy left in the exhaust steam is capable of doing a good deal of work in the turbine, and this power can be applied auxiliary to that of the main engine, employed to drive a dynamo, or for any other purpose. This scheme emanating from some one else would seem visionary, but Mr. Parsons is not a visionary man, and knows precisely what he is doing in engineering matters of all kinds.



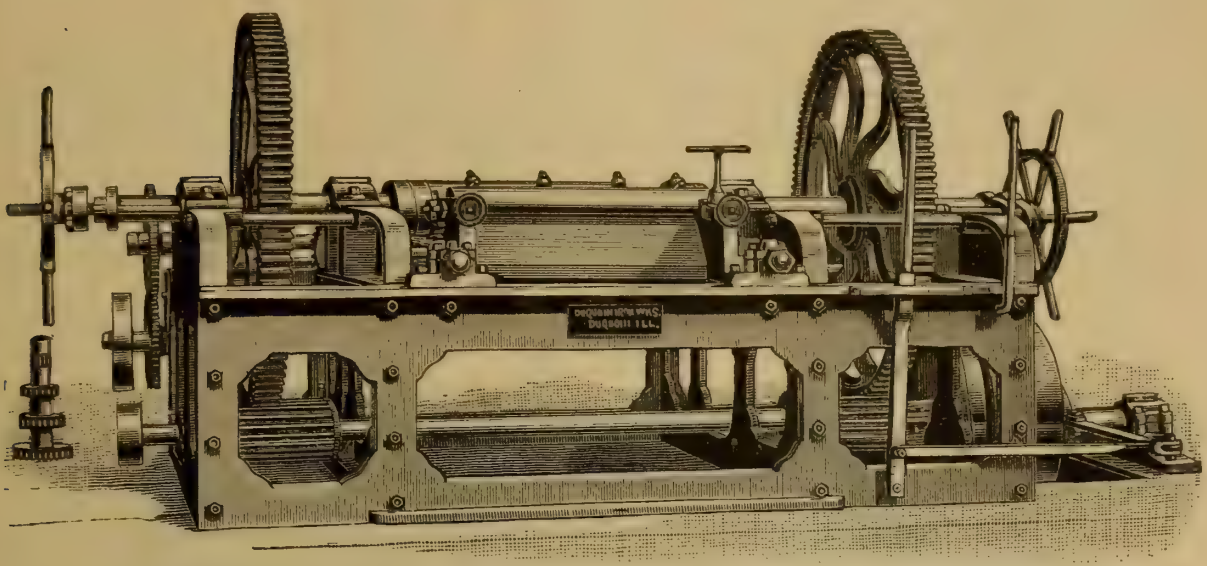
20 HORSE POWER MARINE GAS ENGINE.

THE UNION GAS ENGINE CO., SAN FRANCISCO.

In another place in this issue, on page 288, we have some remarks on the gas marine engines made by the Union Gas Engine Company, in this City, and since writing that article have received and engraved the drawing above, which is typical of various sizes of such engines, of both greater and smaller power.

The drawing will fully bear out the claims elsewhere made in respect to the design and arrangement of the engines. They are made to consume gasoline in its liquid state by means of a "vaporizer," seen in front, so there is no accumulation of gas or vapor, consequently no risk of explosion.

In these times of extreme interest in local industry on this Coast, a manufacture or enterprise like this is deserving of recognition and encouragement by every means that can be brought to bear.



ROTARY SCALE BOARD CUTTING MACHINE.
THE DUQUOIN IRON WORKS, DUQUOIN, ILLINOIS.

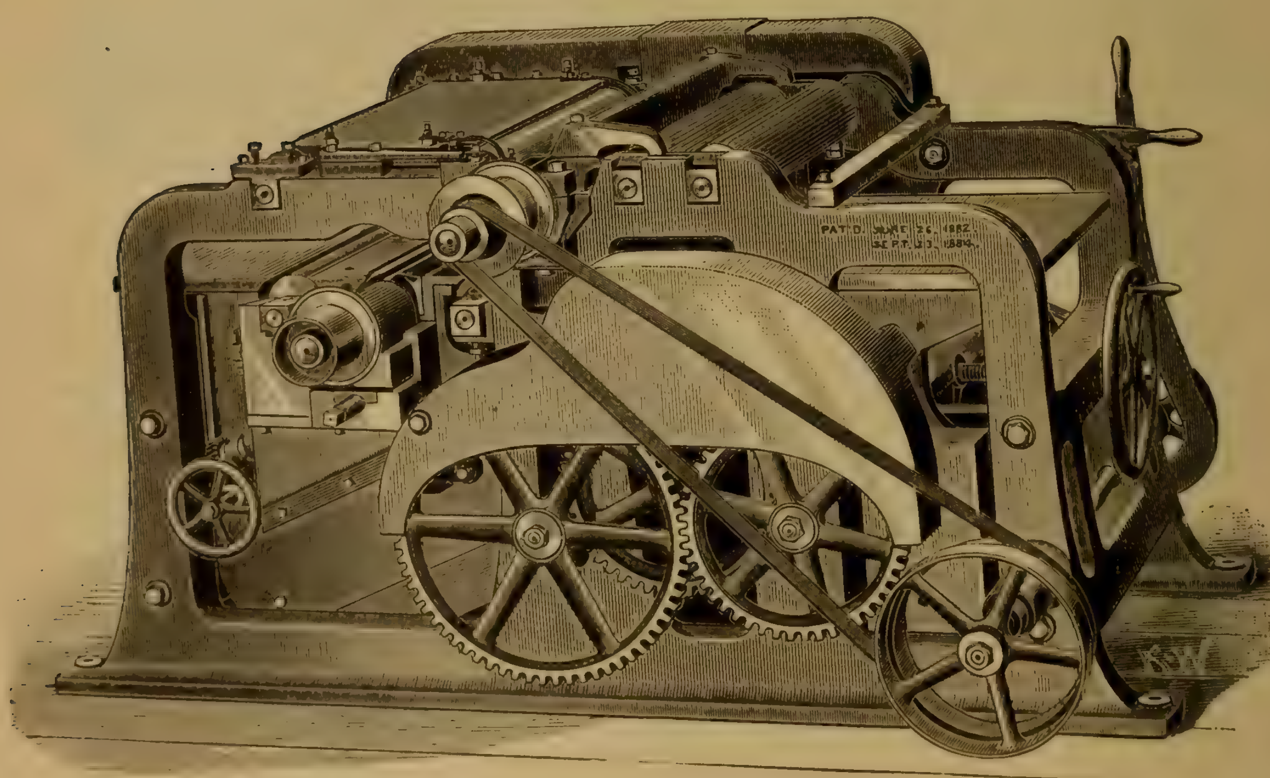
On this Coast, and we may add all over this country, there is a waste of timber that must for economic reasons cease in the near future. In speaking recently to a mill owner we mentioned this waste, to which he replied, "We only make a kerf of 'six sixteenths' with our circular saws." Some years ago we measured the kerf behind circular saws at Portland, Oregon, that was seven sixteenths, which in sawing boards one inch thick reduced nearly one half the timber to sawdust. This was explained as a result of dear labor and cheap timber, which is wholly fallacious. Cheap labor has nothing to do with such a method of sawing, or has but little to do with it, because this same timber could have been cut at the same rate by roller gang mills, using No. 12 saws, making less than one third the kerf.

This waste of timber increases as the boards become thinner until the kind of stock called scale boards or thin stuff represents only a part of the original stock, sometimes a third of it. Such stock should be cut instead of sawn, and by far too little attention is given to cutting processes in this country. In cutting the timber by knives there is no waste. The balk is revolved by powerful machinery in contact with a long knife, that peels off a continuous sheet or web, perfectly smooth on one side, and of uniform thickness.

The drawing shows what is called a Blakeslee machine, for cutting scale boards, made by the Duquoin Iron Works, at Duquoin,

Illinois, that will cut up to 20,000 feet of stuff in a day of ten hours, thick enough for slack barrel staves, or thin enough for veneering on cabinet furniture.

These machines are constructed in a heavy substantial manner, and automatic in action after the rate of feed or thickness of the board is adjusted, and are preferable in every way to the reciprocating type, such as are extensively employed in Europe.



WOOD-PLANING MACHINES.

BAXTER D. WHITNEY, WINCHENDON, MASS.

It is a common opinion, and one supported by the circumstances, that wood cannot be planed smooth by rotary cutters, but is not the fact. It all depends on the method of planing, or the character of the machine.

Some time ago we sent for some examples of planing done on machines similar to the one shown above, and were informed by nearly everyone who examined the work that it was "never done on a cylinder planing machine." These examples, that are now at the Union Iron Works, if not lost, consisted of various kinds of hard and soft wood, planed in some cases to "one sixteenth of an

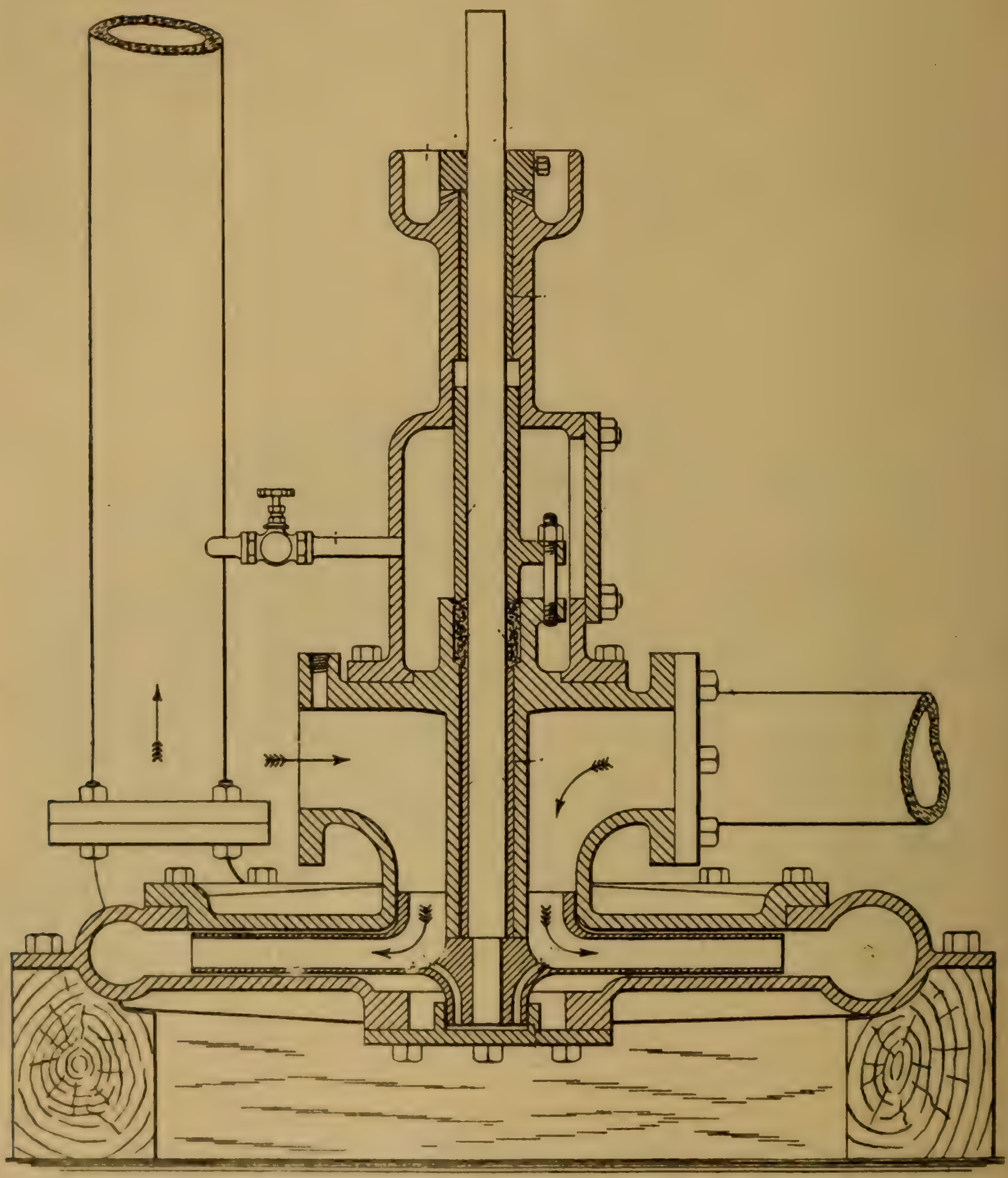
inch thick,'' cut down from stuff half an inch thick, the surfaces polished and ready to receive varnish. Bird's-eye maple, crotch wood, and every kind of irregular grain was included, showing the possibilities of cylinder planing on a machine made to finish surfaces.

One of these machines, to plane one side, was taken to the first Paris Exhibition, thirty-five years ago, and with other ingenious machines by the same maker to finish wood surfaces by scraping, was one of the most creditable exhibits sent from America. The performance of these machines was a matter of astonishment to not only the jury but even to most people from this country. A gold medal was awarded to Mr. Whitney.

The attainment of smooth work in planing is not as is commonly supposed due to great rigidity and weight. While these things may be among the causes or conditions, they are not principal or essential. The main thing is a high speed of the cutting edges, or a slow feed, which is in a sense the same thing. Absolute fit and consequent stability of the cylinder journals, and an immovable abutment opposite the ''cut,'' also good cutters or knives with a proper angle or bevel. In the machine illustrated there is a careful attention given to all these things. The beds rest on wedges or inclined planes that slide beneath, so that no yield or vibration is possible.

The present notice of these machines grows out of a communication sent some time ago to Mr. Whitney suggesting that he make a small machine for re-planing, or smoothing stuff for painted work, such as is hand-planed and sand-papered on this Coast, a kind of by-machine that could be called into use for fine work, and this suggestion arose from finding in an estimate for ceiling a room an item for hand-planing and sand-papering that exceeded the cost of the planing and matching.

All the ceiling of this room could be run through a machine like the above in ten minutes, and would be more perfect than if hand planed, so also the whole of the painted surfaces. Such a machine is not suited for thicknessing or rough work, at least cannot be used at the same time for that and fine work, but would be a paying investment in any mill for second planing surfaces that are to be painted or varnished.



CALIFORNIA CENTRIFUGAL PIT PUMP.

BYRON JACKSON, SAN FRANCISCO.

Last month we gave some space to the subject of what is called pit pumping for irrigating purposes on this Coast, and in answer to inquiries respecting the pumps themselves we publish the vertical section above, showing in a very clear manner a pump of this kind, inverted and having double inlets.

There is of course a good deal of difference in various details, but the main elements are much the same by different makers. In the present machine the pump gland is flooded to prevent the entrance of air, and the wheel or impeller is partially balanced by a thrust chamber at the bottom, that is, balanced to the extent of being in equilibrium at an assumed head or pressure. The diameter of these pumps is varied to some extent with the head to be pumped against. Such heads, as stated last month, vary from 40 to 100 feet, and in some cases 150 feet, or at a pressure of 65 pounds per inch. The drawing is clear enough to not require explanation.

IMPULSE STEAM ENGINES.

The Metropolitan Central Electric Company, of London, some time ago removed one half of their steam engines and replaced them with Parsons' impulse engines, or turbines as they are called. The result has been so satisfactory that Mr. Parsons has been requested to remove the rest of the piston engines and replace them with turbines.

In a recent letter of Mr. Parsons to Mr. Charles Brown, of Basel, Switzerland, he says that his orders for ninety days past amount to 8,000 horse power of the steam turbines, and his works have to be operated day and night until extended.

Mr. Brown, who is a high authority, says in speaking of these steam turbines:

"I think this will bring down the cost of central stations to one fourth the present outlay, for the following reasons.

(1) The combined engine and dynamo costs not more than one third of the usual price.

(2) Space occupied is not one fourth that now required, therefore great saving in building.

(3) No expensive foundations required.

(4) No expensive overhead cranes required.

In exploitation we save:

(1) In coal and water, the consumption of feed water being only fifteen pounds per *electric watt hour*, a figure unattainable so far by other methods.

(2) Scarcely any attention required, thus great saving in wages.

(3) A much steadier current is obtained that may be compared to that given by a storage battery.

(4) Close governing, far beyond what is now obtained by the piston engines."

MARINE GAS ENGINES.

The extent to which petroleum engines are entering into the marine service of the bay and rivers, is indicated by what was seen on a recent visit to the Union Gas Engine Company's works in this City.

There were in process engines of all sizes, up to sixty horse power, and orders ahead for months to come. The type after passing through usual changes has settled down into what may be called a marine form, simple, compact and symmetrical, and the workmanship is "marine" also.

This latter is a point of no little importance in marine engines of all kinds, whether gas or steam. The circumstances of use are severe, and failures much more serious than on land. By workmanship is meant both material and fitting. There must be a plentiful use of non-corrosive metal and forged parts in such engines to avoid break-downs and galvanic action.

We are much pleased to see so complete a development of this business here. It will be permanent, and have its effect not only as a local industry but on carriage in the bay and rivers of the Coast.

People here do not understand the extent and importance of this gas-engine industry, which has grown to proportions no one would have conjectured five years ago. The suddenness with which it has sprung up is an indication of the want that existed for small power motors on this Coast, and if statistics were ascertainable there is no doubt a wider use here of such engines than in any other part of the world.

The limitation of capacity is not due to the nature of the engines so much as to the art being new, and the risk of constructing large engines that might soon be superseded by improvements. We can see in the Union Gas Engine Company's new works signs of heavier engines, in both handling tackle and implements, especially over-head travelling cranes to span the erecting floor.

Aside from gas engines there is more activity in the various machine works of this City than is commonly believed. People are apt to consider low prices the same thing as dull trade, and it is in a sense, but only in a limited sense.

SEWERAGE IN FOREIGN CITIES.

In July of last year, the Department of State, at Washington, sent out a circular to various American Consuls in European Cities, asking them to send in reports on the sewerage systems of the places where they were stationed, among others to Consul C. W. Chancellor, at Havre, France. Being familiar with the subject, and there being no system of sewerage at Havre to occupy his attention, he sent in a valuable essay on the general subject, from which we produce the following:

"There is no branch of public health so complex, so incalculably difficult to grapple with, as the proper drainage and sewerage of large cities, yet it must be remembered that unless this be efficiently done, an ultimate limit is set by man himself to communities, if not to nations.

The soil of many of our cities, saturated with the putrifying contents of cesspools and leaking sewers, emits at certain seasons the poisonous emanations which generate typhoid fever, yellow fever, diphtheria, dysentery and cholera, while the waters of our principal rivers are too often converted into open sewers teeming with pestilential exhalations. The government of every state, whose duty it should be to superintend and watch over the health of the community at large, would do wisely to lay down and carry out an efficient, complete, and common-sense plan of drainage and sewerage for every town and city of the commonwealth.

Were the fearful consequences which result from the reprehensible practice of converting our rivers into open sewers properly understood and properly estimated by the public, no expenditure of time or money would be deemed too great to put an end to a system so disgusting and so destructive to the health and lives of the community at large; but more especially of those whose avocations necessitate their daily and hourly exposure to the evil. Unless this suicidal practice is abated, by penal enactment, our cities will ultimately become the hotbeds of pestilence and plagues, such as prevailed in the middle ages.

Favorable as the site of ancient Rome, extending over her seven hills, might at first appear for habitation and defense, it may be safely said that we should never have heard of the eternal city, never would she have become mistress of the world if her rulers and people had not early felt the importance of sanitary measures, and carried them out with a persistence and an ability which should serve as models for all succeeding ages. With not only an intention to meet existing wants, but with apparently a prescience of the future greatness and dominion of Rome, the work of drainage and sewerage was begun by her monarchs, and continued during the Republic, on a scale of such magnitude, and in a manner so enduring as to be unequaled by any

subsequent labor of the same kind in other countries. The 'Cloaca Maxima' and its affluxes, or branch sewers, rival the largest of the pyramids in solidity and amount of material, and exceed them all in unquestionable utility. Earthquakes, the pressure of buildings, the neglect of two thousand years have not moved a stone out of its place; and for thousands of years to come these vaults will stand uninjured as to this day. The lesson of the drainage and sewerage of Rome is a fruitful one, and ought never to be lost sight of in the founding and laying out of new towns. In many of these, a proper system of drainage and sewerage is an afterthought, and hence when executed, it is at an immense cost, and often after much sickness, suffering, and mortality among the first inhabitants.

The sewage of large towns and cities consists of the excretal discharges of the inhabitants and of many lower animals; of the foul and contaminated waters of the households, stables, manufactories, and other establishments, and of refuse matters in a state of decomposition from markets, slaughter-houses, and other places.

The combined quantity of these matters has been estimated at about 7 cubic feet (50 gallons) per diem for each individual, which, for a city with a population of 100,000, rises to the daily average of 5,000,000 gallons, and annually to the astounding quantity of 1,825,000,000 gallons.

To dwell upon the necessity of the immediate and continuous removal of this immense mass of poisonous matter, far away from the precincts of human habitations, or to discuss the disastrous results which must almost necessarily follow their retention in populous communities, would seem superfluous, and yet we find intelligent citizens and legislators, almost everywhere, doubting, hesitating and procrastinating."

Of the great sewerage system of Paris, of which we have heard so much, and rendered famous by Victor Hugo in *Les Miserables*, Consul Chancellor says:

"The vast dimensions of some of the Paris sewers do not prevent their being denounced on all sides as unsuited for the work to be performed; the fall is insufficient, the water supply inadequate, and the solid deposits are so great that an army of 1,000 men is employed to keep them from becoming obstructed by pushing along the solid matters. It has been found that, unless this course is pursued, the heavier sewerage matters will remain several weeks in these underground passages before they reach the outlet, fermenting and evolving gases of the most dangerous character, which accumulate and are liable to be pressed back into dwellings by every downpour of rain, or 'flushing,' which sends an unusual quantity of water through the sewers, thereby raising the normal level of the sewage flow and lessening the area occupied by the gases.

The city of Paris has more than 800 miles of subterranean pipes, of which about 500 miles are sewer pipes. The largest of these sewers were constructed at a cost of from $60 to $70 per running meter

(39.37 inches); the medium size from $40 to $50 per meter, while the smallest cost from $15 to $20 per meter. The daily attention to these sewers, with 1,000 *egoutiers*, or sewer cleaners, 20 boats, and 50 wagons, cost annually about $800,000, while the entire maintenance of the system and the cleaning of the public ways figure in the annual appropriation at nearly $5,000,000. In addition to existing sewers, Paris is said to be on the point of undertaking a colossal sewerage scheme, the cost of which is to exceed 100,000,000 francs ($19,300,000) which will provide for the treatment of a large proportion of the sewage by irrigation at St. Germain."

After various observations on the general subject, Consul Chancellor presents the following views on modern systems of sewerage in cities:

"(1) *The combined or water-carriage system.*—This system exists in nearly all English towns of any size; also in Paris, Brussels, Berlin, Frankfort, Hamburg, and in a few other continental cities. It consists in treating all sewage, rain water, subsoil water, household and manufacturing wastes alike, by conducting them off in one and the same conduit, a large volume of flushing water serving as a means of conveyance and to prevent sliming of the inner surface of the sewer walls, so fruitful of the production of poisonous gases and pathogenic germs. This, in a word, is the *tout a l'egout* system, which has been hotly assailed by many distinguished engineers and sanitarians both in Europe and America, on the ground that every addition of the moving or flowing force of the sewage matter, obtained by increasing the quantity of water, must of necessity decrease the value of the sewage as a fertilizer, and in a like ratio, increase the difficulties of its final disposal.

As a health measure, the combined, or English system, is now almost universally condemned as absolutely and irreconcilably in conflict with the requirements of modern civilization and the teachings of sanitary science. In London, where the system exists in its greatest perfection, it has been found to foul both air and water to such an extent that some supplementary arrangement is deemed necessary, and propositions to this end are now being discussed. In Paris, where the system prevails to a great extent, typhoid fever has become endemic, killing from 1,000 to 3,000 persons annually; and the epidemic prevalence of cholera at Hamburg in 1892 would seem to indicate a widespread aërial poisoning, in addition to the polluted water supply.

The weight of testimony against the water-carriage system, or the *tout a l'egout*, and in favor of a separate canalization for excretal and household sewage is so overwhelming that nothing could be more conclusive as to the evils of the one and the value of the other.

(2) *Pneumatic systems.*—The problem of rendering cities healthful by the rapid removal of excremental matters and household wastes, is, in a measure, solved when we can get rid of such matters without any possible connection between them and the surrounding

air and soil. The advantages of such a system may be briefly stated as follows:

(*a*) It prevents the emanations which a protracted stagnation of excremental matters will give rise to, when the dejections are deposited in cesspools or are allowed to decompose in large water-carriage sewers.

(*b*) It prevents the introduction of dangerous matters into sources of drinking water and into the surrounding earth, and thereby greatly lessens the danger of epidemic diseases being transmitted through infectious germs contained in fecal matter.

(*c*) It secures the rapid removal of all excretal and household sewage in a manner to satisfy the requirements of health and economy, and in a condition to render its subsequent utilization as a manure not only possible, but easy of accomplishment.

Several pneumatic systems of sewage have been experimentally applied, each in harmony with suggestions made by M. Belgrand, inspector-general des Ponts et Chaussésś, and Baron Haussman, Prefect of the Seine, as far back as 1861. Both of these distinguished engineers recommended that the excretal sewage of Paris should be conveyed from the houses by a network of metalic pipes leading into special air-tight tubes which would convey the matter rapidly to a point outside the city, where it could be treated or disposed of for agricultural purposes.

The application of a pneumatic system for the discharge of sewage matters was proposed at Paris in 1862 by Aristide Dumont, but it did not succeed. The idea was reproduced in 1872 by Capt. Charles T. Liernur, a Dutch-American engineer, who suggested another method of discharging excretal sewage by aspiration. This method, known as the Liernur system, was introduced in parts of Amsterdam, Leyden, Dordrecht, and, to a limited extent, at Prague and Hanan, but the system has not been further developed, owing, no doubt, to its excessive expense, and its limited application to the purposes in view. Finally, in 1878, a French engineer, M. Berlier, in charge of the sewage works at Lyons, substituted for movable vessels a subterranean iron conduit, through which the excretal sewage, from a certain point on the quays, could be drawn by aspiration to the works, a distance of three kilometers (about two miles). This plan, however, does not seem to have been extended in Lyons. In August, 1881, the municipal council of Paris authorized the installation of the system in two districts of the city. After ten years of trial it has not been extended, nor has it been introduced in any other city, for the obvious reason that, like the Liernur system, it is not designed to deal with more than one per cent of the sewage, viz: the excretal sewage. What is needed is a pneumatic system that will deal with the whole of the soiled waters from the house, leaving only the surface or storm water to be conveyed off through an independent channel.

(3) *The Shone hydro-pneumatic system.*—Perhaps the nearest approach to a system of sewerage which fulfills all the essential

conditions for the removal of household sewage, required by a due regard of the laws of sanitation, is a combination of water-carriage and pneumatic principles, introduced to the public by Mr. Isaac Shone, an English engineer, in 1872. It may be briefly described as a system of distributing stations for the lifting of sewage, worked from one central station by means of compressed air, whereby the whole of the drainage area is divided into a number of compact districts, each with its separate outfall, and discharging into one common main leading to the ultimate common outfall.

The system enables town authorities to successfully drain flat, as well as undulating, surfaces, and to lay the gravitating sewers at good self-cleansing gradients, in shallow, and consequently, inexpensive trenches. It also admits of the very smallest sewer pipes which it has been found practically safe to lay down in order to prevent chokage from sewage proper, being used in the lowest as well as the most elevated town areas. Such sewer pipes can be laid, even in the flatest districts, at gradients steep enough to render them self-cleaning, with the minimum of flushing power.

The Shone system has been in successful operation for the past fourteen years at Eastbourne, England, and as the town area has been extended new installations have been put down from time to time, without interfering with the efficiency of the system. It is also in operation in at least fifty other places in England, including Southhampton, Warrington, Preston, Hastings, parts of London, and in many towns abroad, including Karachi and Bombay, India, and Kieff, Russia."

TESLA'S EXPERIMENTS.

The story and genesis of the researches and experiments of Nikola Tesla are told in *The Century* Magazine for April by Mr. T. C. Martin, and has set the talking world at work in a vigorous way. Such an article at this time in a secular serial, and with some embellishments and furtherances that are slightly theatrical, will in the minds of many people lead to an inference that the experiments are ended, and that the phenomenon has no great bearing in a practical direction. This "sordid" inference is the one we draw, and the destruction of the laboratory of Mr. Tesla since then may be a great loss; perhaps not. He has done a great deal of practical work of a highly useful kind, and his divergence into the ocult field of high frequency led him away from the practical path, ending in a maze among the stars, so to speak.

The mechanical proposition of following the frequency of electrical pulsations or waves with the action of elastic and expansive gases comes more within the field of tangible ideas, but the omission

of rotary motion in generating apparatus, and the substitution of "direct reciprocation," is something that affords material for serious consideration, also admits of the remark that if some one more familiar with the kinetic elements of the machine was to join the great electrician the result would be more hopeful.

The engine or "oscillator," which furnishes the title to Mr. Martin's article, is graced with a timid quarter of a page of minute type, which by inference no one is expected to read. The principle or mode of operation is, however, set forth in clear terms by the writer. The scheme has some, but not great promise. No operation in the mechanic arts, if we except short quick blows, has admitted of direct reciprocation at high speed. Rock-drilling machines, caulking and hacking implements are examples. No one well informed in mechanic art ever leaves rotative for reciprocating movement. It is the destructive element that limits speed, destroys parts, and sets up strains not computable and resisted only at a great deal of expense. If the same electric functions are attainable by rotation, there is no need of reciprocating parts for air or steam. The modern steam turbine answers all the purposes of translating energy from a boiler to the rotary elements of the electrical apparatus at a speed of 2,500 feet per minute, with which an "oscillator" holds no comparison.

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

This Society held their regular monthly meeting on the third of last month, when Mr. M. L. Cook, of Riverside, Cal.; E. F. Rossow, of Vallejo, Cal., and A. J. Frye, of San Francisco, were elected members. Three new names were proposed for membership and referred.

Mr. J. D. Isaacs, C. E., member of the Society, presented and read a paper on "Stopping a Troublesome Slide at a Summit Tunnel," which paper formed the subject of an extended discussion in which a large number of the members present participated.

A communication was received from the Trustees of the Mechanics' Institute, in this City, relating to a scheme for in some manner connecting the Technical Society with the Institute. This communication imposed conditions in respect to affiliation, which the officers of the Technical Society did not think expedient to concede, and the matter will no doubt rest for the future.

Such an affiliation is by reason of the very different character

and objects of the two organizations nearly impossible in any form acceptable to each. One is a society for research in technical subjects, without property or commercial interests, as all societies of the kind should be; the other an association largely or even mainly devoted to business objects and the maintenance of a valuable library. There is no common object in these things, so that "amalgamation" is not possible, and is doubtless inexpedient.

GAS ENGINES FOR STREET CARS.

To United States Consul General Frank H. Mason, at Frankfort, we are indebted for the most complete information on various technical subjects collected by the Department. They give evidence of much special information, as well as close observance on his part.

In April, 1894, he sent a most interesting and complete report upon the use of gas engines for street car driving in Dresden, and now supplements it with a farther report, saying that a car of the kind is to be sent to this country for trial.

The following is an excerpt from his last report:

"Outwardly the car's appearance is precisely similar to that of an ordinary double-decked horse car, having stairways on each platform to the seats on the roof. All the machinery is inclosed and concealed from sight. There is no smell of gas, no noticeable heat from the engine, and no undue noise or jar when the car is stopped or set in motion. The motor is a double-cylindered gas engine of the Otto model, placed under the seat at one side of the car, and reached for the purposes of oiling, cleaning or repairs, by doors which form panels in the outer wall of the car, and when closed are not noticeable. The engine is of the latest type, in which the gas is ignited at each stroke by an electric spark from a small battery in the engine space, so that the car is put into or out of service by turning a knob, which opens or closes the circuit.

The engine is kept in motion while the car is in service, and the whole is managed by the driver, who, standing on the front platform, has within reach the brake wheel, on which is fixed the alarm bell and a movable lever, which when in an upright position leaves the engine disconnected with the running gear of the car, and cuts off the gas supply, so that but one explosion takes place at each eighth revolution, the motion of the engine being meanwhile maintained and steadied by the flywheel, which is four feet in diameter, and of corresponding weight. When the lever is pushed to the left it turns on a two thirds supply of gas in both cylinders, and brings into engagement a friction clutch which connects the engine shaft with the wheel axles, and gives the car a speed of 4½ miles per hour. Pushing this lever to the right turns on the full gas supply, and

brings into connection a friction clutch of larger diameter, which gives the car a speed of 9 miles an hour. A second lever is provided for reversing the engine and direction of movement.

The gas supply is carried in three cylindrical reservoirs of boiler iron about ten inches in diameter, two of which are hung transversely under the floor at each end of the car, while the third is placed beneath the seat at the side opposite the engine. The weight is thus to some degree equalized. The three reservoirs weigh together about 550 pounds, and contain 33.5 cubic feet of gas, condensed to a pressure of 8 atmospheres by means of an ordinary force pump at the end supply station. This pump is worked by a gas engine of 8 horse power. The whole apparatus costs, in Germany, $2,380.

THE BANK OF ENGLAND.

This great financial institution was founded 200 years ago by a Scotchman named Paterson, who procured from William and Mary a charter for eleven years, loaned them, or the government, all his money, over a million pounds sterling, and was employed by them to manage the bank at a salary of £4,000 a year.

The bank was at first in Grocers' Hall, the present building in Threadneedle Street being commenced in 1734. A little before this time the bank went through the South Sea bubble, and survived; its notes, however, went down to 75 per cent. of their face value.

The Bank of England is not a government bank, as is commonly supposed. It holds the government securities, and pays out the funds spent, or, as we may say, acts as treasurer for the government. It is managed like other banks, by a board of directors, commonly merchants, and there are quite a number of the business firms who keep their accounts in the Bank of England. The issue of notes is about $125,000,000, and these notes are a legal tender, except when paid out by the bank itself, and are better than gold, bringing in some countries a premium.

The business is divided into two parts, the issue and banking departments. The resources are not known, in fact scarcely determinable. In 1891, when Baring Brothers failed, the Bank of England started a guarantee fund to save the great merchants, as they are called in London, heading the list with £1,000,000. This was in a few days raised to £82,250,000, and the liquidation of Baring Brothers then commenced, and lasted for several years.

The strangest thing of all is, however, that the Bank of England does business just the same as any other bank, and has all kinds of accounts with trades people of respectability.

LITERATURE.

The Free Trade Struggle in England.

BY M. M. TRUMBULL.

The present is a second edition of this work, sent by the Open Court Publishing Company, of Chicago. The first edition appeared in 1882, and was the first concise and compendious history of what has proved to be one of the greatest facts in the world's commercial history.

Mr. Trumbull, who died last year, was an indefatigable student in economical and social problems, also a man of much learning in various branches of science, and Republican in politics.

He, with many others, or indeed all others who have given the subject impartial study, believed that the laws of commerce, like others affecting human interests, are universal and immutable, and that the evolution of the system of free commerce in England would have to be followed by other nations to save themselves being owned by this system of exchanges.

The war, it may be called, conducted between the protective and free trade parties in England from 1838 to 1846 is a story of intense interest. The arguments and propositions that emanated from both sides comprehended all that has since been set up in other countries, and were vehemently pressed, but as the free trade party was for the "nation," and their opponents for a "class," but one end was possible.

The account of the change of the opinions and policy of Sir Robert Peel is one of the most interesting sections. In his speech, which announced his change of views, he quoted from a report of the Secretary of the Treasury of the United States as follows:

"By countervaling restrictions we injure our own fellow citizens much more than the foreign nation at whom we purpose to aim their force, and in the conflict of opposing tariffs we sacrifice our own commerce, agriculture and navigation. Let our commerce be as free as our political institutions. Let us with revenue duties only, open our ports to all the world."

Then added:

"I am about to act on this presumption, that during the period of the last three years there has been in this country an increased productiveness of revenue, notwithstanding the relaxation of heavy taxation, that there has been an increased demand for labor; that there has been increased commerce; that there has been increased comfort, content and peace in this country, and I say that the enjoyment of these benefits has been concurrent with the policy of repealing prohibitory and reducing protective duties."

The work, which is good reading for both sides of the problem, contains 200 pages, is sold in paper cover at the astonishing rate of 25 cents; in cloth cover, 75 cents, by the Open Court Publishing Company, of Chicago.

Elementary Machine Design.

BY PROFESSOR A. W. SMITH, STANFORD UNIVERSITY.

This is a second work by Professor Smith on elementary machine design. The first, issued in 1892, related to the nature and selection of material, and the present work, as we may say, to the disposal of the material.

The work is unique in both its make-up and subject matter, and compendious in a degree that no one will conceive possible, and would not be possible except prepared as this has been mainly for demonstration before classes in the University.

Professor Smith has the advantage over most of his colleagues in being able to look at and treat a problem from "each end," its inception and application. Whatever he does, whether it be text, graphics or mathematics, bears the mark of his practical experience in the works, and by going back from the thing or fact to the elements of its production he finds a way half as long as by going the other way deductively.

A page of sketches, almost free hand, and another page of simpler text, disposes not only of the elements involved in a problem, but also a conception of how the thing itself is made and used.

There are in 160 pages sixteen chapters or divisions, beginning with a preliminary statement on the nature of the elements in

machine design, then motion in machines, energy in machines, parallel movement, gear wheels, and so on.

We had predicted this work of Professor Smith, and now can foresee another, dealing with machine functions, and while, as said in the first line of the present book, "one can never become a designer of machines by studying a book," he will come nearest to doing so in this series when it is complete.

Published by the Palo Alto Press at the University, price $1.75.

Consular Reports.

No. 174, March, 1895.

U. S. Commercial Agent Stephen H. Angell has sent in to the State Department a report on "Labor in France," one of the most extensive and thorough that has ever appeared. It is however in the main a compilation of the French Reports by Mr. Jules Lax, which like all public documents of that country is prepared with extreme care.

Two things contained in Mr. Angell's paper will be a matter of some surprise. One is the number of workmen engaged in "piece work," and the other the rate of wages, which is much higher than is commonly supposed, not relatively perhaps, because there has been continuous effort for twenty years past to make France a "dear" country, and wages must be considered in respect to general prices.

Taking the machine industry as an example, the wages average about $1.25 per diem for ten hours, rising in certain trades to $1.75, and we must remark that Mr. Angell has taken the pains to convert the money to dollars and cents, by no means common in Consular Reports. He has also given the actual wa.es and the rate for ten hours. In a summary at the end we find the following for ten hours' work:

Iron works	$1.10
Iron works, constructive work	1.14
Stone cutting	1.66
Public works, bridges, etc	1.23
Woodworking industries	1.24
Textile Industries	.70

The average of all kinds of work is set down at $0.96½ per day of 10 hours, or actually 20 per cent. more, making $1.158.

Consul J. C. Monaghan, at Chemnitz, sends a long paper on the "Technical and Naval Schools of Germany," which if our space permitted would be extensively quoted.

In this division is one chapter on horseshoeing, from which it seems that in Saxony at least, no one is permitted to shoe horses unless examined and licensed. A great school at Dresden has students from all parts of the world studying "farriery." This includes not only shoeing horses but their care and treatment, a provision that saves a great deal of money for the farmers and others owning horses.

Register of the Cornell University.

This munificently endowed institution, with more than sixteen hundred students, has a first place among the educational establishments of our country. It is eclectic and conforms to the scheme of its patron and founder, Ezra Cornell, who said, "I would found an institution where any person can find instruction in any study."

A map of the campus shows by profile lines a picturesque topography, between two streams, dotted over with one hundred and two buildings, scholastic and private.

It is remarkable in looking over the list of the faculty and studies to see how large a portion pertains to what may be called the constructive arts. The Sibley College, over which Professor Thurston presides, seems the most extensive department of all.

Honduras and Salvador.

(Bulletin Nos. 57 and 58 of Bureau of the American Republics.)

The present volumes, making up 340 pages, covers the two countries named. They can well be considered together, as Salvador seems to be a corner or end cut off Honduras.

Fine maps are included, also a number of photoplates of noted places and typical subjects. The bulletins are uniform with the other publications of the Bureau, and when bound will consitute a valuable library reference. In fact a set of the Bureau's publications constitute a whole library of themselves, and a store of information respecting Latin America that never could have been arrived at by other means than are here employed. The set, to so call it, of these publications must be nearly complete, numbering, as above stated, nearly sixty volumes and pamphlets, a portion of which were not consecutively numbered.

LOCAL NOTES.

The new San Joaquin Valley Railway, to be built by enterprising people here and in the valley, is to be commenced at Stockton, and built from there to Bakersfield. This is a wise conclusion, and means an avoidance of the bond evil, which swamps most enterprises at this day. Bonds issued at a discount to bear a high rate of interest is a poor foundation for any business, is in fact an impossible one, and the principal fact, the one that insures success in this enterprise is the proposition to begin and construct the main line with the proceeds of shares sold. When bonds are required to provide an entrance and terminal in this City there will be property to secure them, or to use plainer terms, there will be property to secure borrowed money, and the terms will be low enough to render borrowing expedient. If the company will keep their capital account as a merchant does his, that is based on real values, success is assured in every other way.

It may be an exceptional view, but taking into account the railway situation in this country for two years past, there are certainly enough trunk lines, and the country as a whole would be better off with half the mileage that exists. But a paid-for line valued at its cost is another matter altogether, and cannot help succeeding, because its profits, based on actual capital, should be as three to one over the inflated and fictitious stock and bonds of the "receiver" lines. Happily the San Joaquin enterprise is in the hands this far of business men, who have in view legitimate and stable business. It will be a redounding credit to this Coast if a local railway can be built, and the capital account be represented continually in tangible assets. We could say a great deal of the projected road, but of all things want to say that it will be built on business principles. The rest will take care of itself.

Of the circumstances attending on the construction of a second line up the valley we need not say anything. It has been discussed in all its aspects over and over again, but there is one method of raising the required capital for this and other lines of the kind, which we hope to see tried, that of taxing the land on each side of

the line in proportion to distance, and issuing the shares directly to the land-owner as a permanent asset or element of his land. This scheme was proposed by Mr. G. N. Cornwell, of Napa County, himself a large owner in the San Joaquin Valley, and has all the appearance of fairness and the assurance of permanent success. He proposed that land along the line be assessed at a price per acre, and the shares issued like a water right, as a permanent attribute of the ground. If the owners did not have the money required they could hypothecate the shares as security, which would not in fact be an incumbrance, because more than represented in the increased value of the land. This would make a "land railway," owned by the people served.

The Cahill & Hall Elevator Company, of this City, have published an album containing eighteen fine photoplates of prominent buildings supplied with the hydro-steam and compensating elevators made by this company. Among the buildings are the State House at Sacramento, the Union Trust and Pacific Mutual insurance buildings in this City, also the Phelan Building, the U. S. Mint, Olympic Club, Savings Union, Columbian, and others. This industry, founded only eight years ago, is an evidence of what skill, confidence and energy can do in a difficult branch of engineering work on this Coast. At the present time the company are preparing to operate elevator machinery on what is called the direct electric system, and while these plans have not been given out, we will venture the opinion that they will not include ball bearings.

Messrs. Knight & Co. of Sutter Creek, Amador Co., inform us that the Risdon Iron Works, of this City, are to act as agents for the Knight Water Wheels, of which there are now over 450 in use. These wheels are of a combination type, operating mainly by impulse, but in cases where a large amount of water is to be applied, partaking of the nature of pressure turbines. Messrs. Knight & Co. make a wide range of hydraulic apparatus besides water wheels, including direct acting pumping engines, which as we believe are the only really successful ones of the kind anywhere in the world. There are some old ones in Southern Germany, working at a slow rate with reasonable efficiency, but not approaching those of Knight & Co., such as are now in successful use in a number of mines in this State.

The paper on The Iron Industries of this City, and of the State, presented by Mr. R. S. Moore, of the Risdon Iron Works, at the Manufacturers' Convention, was ably and logically prepared, but, as we think, it too prominently conveys an inference of high prices for iron products on this Coast. That most kinds of machinery cost more is unquestionably true, but there are exceptions, and many cases where it costs less. The main difficulty is unstable or irregular prices, and the fact that popular opinion is founded on the highest rate. People often place orders in the East for what they could purchase cheaper here, and have actually bought from Eastern firms, machinery that was made here in San Francisco, under an apprehension that it was cheaper to do so. "Work is made here cheap enough to estimate," remarked a friend recently, this meant a good deal; it meant that there was an uncertainty in prices and profits.

Messrs. Stieger & Kerr of the Occidental Foundry, in this City, have "taken the bull by the horns," so to speak, and have gone into stove manufacture. If the firm was a new one, or pursued less methodical methods, one would consider this a bold movement, in view of the great works in the East and their organization, but Messrs. Stieger & Kerr know very well what they have to contend with, and are not proceeding on general principles. Their work will be good, that can be depended upon. The reputation of the firm and their past experience in the most difficult branches of foundry work assures this. The new works at Main and Harrison Streets, are by far too commodious for the machinery trade. The equipment is new, and includes electrically driven cranes with other features of advanced practice in foundry work.

There are some advantages in living in an isolated city, or one removed from the base of common supplies. Here in San Francisco, one can in a single establishment procure what would have to be sought for over half New York, Philadelphia or Boston. In books for example, no house in London or New York keeps on hand such a retail stock as is found here, but the largest aggregation is in what may be called industrial supplies. In a "hardware store" here, can be seen a hundred clerks or salesmen operating from a central counting room, machine works that are ready to make a steam ship, a locomotive or a wheel-barrow. A mine or other

establishment in the interior needs but one account in San Francisco, and may order iron, timber, hardware, oil, tools, wagons or wheelbarrows from the same merchant. It is a necessity here.

The Los Angeles and Pasadena Electric Railway Company, are now installing a plant of 1,000 horse power. Mr. L. C. Russell, of this City, who is erecting the machinery, writes that the fuel to be burned is oil, that costs 85 cents a barrel, three barrels being equal to one ton of good coal, or corresponding to $2.55 per ton for the coal, which is about a third of what it costs there at this time. This we do not understand, as the cost of fuel should be nearly equalized everywhere. The oil is produced on the ground, so to speak. Mr. Russell says there are hundreds of oil wells in Western Los Angeles, bored all over the place, flowing from 12 to 48 barrels each in 24 hours. If fuel at the rate named is found in Los Angeles, and the supply permanent, we can look for a wonderful accretion to the wealth and growth of that already progressive city.

The Krogh Manufacturing Co. of this City, have purchased the business of the San Francisco Tool Co., including patterns, connections, material and stock, and will continue the manufacture of centrifugal pumping and other hydraulic work carried on by the old company. The Krogh Company have been engaged in a similar line of work, the construction of water-raising machinery, and will combine the former business with that carried on by the Tool Company. The plant and buildings on Stevenson Street are occupied by the new business. The facilities are among the best on this Coast, and embrace a full equipment of efficient implements and all other appliances. The present depressed state of the agricultural interests have greatly reduced the demand for hydraulic apparatus of all kinds, but there is promise of much improvement during the coming summer.

COMMENTS.

The present Commissioner of Patents, Mr. J. S. Seymour, has instituted a number of changes in the rules of procedure in the office, some of which affect in considerable degree the conduct of business there, and have met with strong opposition, naturally perhaps, but evidenced in a way very serious for applicants and their agents. The examiners have either through instructions, or in a kind of opposition spirit, taken a position in their rulings that comes near debarring all useful claims, that of citing irrelevant references, and confining the scope of claims to definite constructive features. Of course any well-informed, or indeed a half informed, person does not desire claims that are invalid because of precedents and previous inventions, but actions go farther afield than this, and so far if preserved in as to soon call out a modification of the laws relating to patents.

The examiners in the United States Patent Office are placed in a very responsible position. They collect evidence in the cases examined, and then act judicially upon such evidence. If their function was to pass upon the novelty of inventions, and endorse their views in the record, leaving the applicant in law, as he is in fact responsible for his patent, the dignity and usefulness of the examining corps would be vastly increased. It is no argument to say that without the bar of "rejection" conflicting patents would be granted. This is not the case in other countries, where the fact of novelty is left with the inventor, and it would not be different here. In fact the uncertainty of patents in this country, judging by the amount of litigation, is even greater under our system. An applicant does not want claims that are not tenable, and would not make such claims knowingly after his case had been examined, and as he alone is responsible he should not be subjected to official rejection.

The problem of patent procedure rests to a great extent upon whether such a grant is an act of right or an act of grace. Once patents were purely an act of grace, or a personal privilege without consideration on the part of the patentee, but then there was no

invention, and a patent was merely a monopoly. Now however that patents are granted for inventions only, and as the public can suffer no abatement of right for what they never possessed, that which the inventor created, his position clearly becomes one of right under the statute, conditional of course upon the novelty of his invention. This is the leaning of decisions in this country, where there was no statute of monopoly to precede the patent system, as in England. If the grant of Letters Patent is therefore a right under the statute it is not a light matter for an executive officer to set up new or change old rules affecting the position of inventors.

Among the serial literature of our time, are a number of boys' papers, commonly well made up, but having one fault that sadly needs correction, that of publishing curious information and facts that are not true. Lying at hand now, is one that contains an account of a man with hair of variegated colors; how to tell the time of day by a cat's eyes; some extravagant stories of kings, and so on. Such things read by boys are apt to be remembered, and a result is that at some future time when the reader learns, as he is sure to do, that these stories are only lies, it will create a contempt for more worthy literature. We are thorough unbelievers in the whole system of "Mother Goose stories," fables and the like, as pabulum for small boys. There are enough curious and strange things within the domain of accepted truths, to make up matter for boys' reading.

American manufacturers of boots and shoes have turned their trade into England, and now comes a proof of Mr. Schoenhoff's figures, made six years ago, in respect to wages in Lynn, Mass., and Leicester, England. Wages are nearly double in Lynn what they are in Leicester, but the cost of making boots and shoes is much less under the higher wages. An English journal says, the goods are coming there all the time in an increasing volume, and it is sure to continue. Some years ago, an enterprising firm at Leicester imported a set of American machines, to be operated in their factory. Mr. Schoenhoff on his visit there found this machinery "stored in an attic," and was informed that the workmen would not permit its use. There is no other manufacture in this country that can claim a higher degree of development than boot and shoe making, and nothing has been wanting for twenty years past but enterprise to create an European market.

This country pays away every year about $100,000,000 in interest to foreign investors and money lenders, and as this debt is discharged mainly in farm products exported, the bill will be nearly double this year, because of low prices for such products. The wheat yield of 1893 and 1894 brought $2,000,000 less than it would have done when most of the money was borrowed, sixteen years ago. The yield per acre of wheat has fallen in twenty years, from $13 to $6, or 54 per cent., but the interest account goes on just the same. It is the same with cotton, and almost everything else, not in the same degree, but near it, and we are fast becoming bankrupt over an interest account. To meet this drain by a fictitious ruse, the railway companies who borrowed most of the money have "marked up their goods" about three hundred fold, but the farmer is not helped on by this; he has to foot the interest bill just the same.

The *Iron Age* says, that with an import tax of 60 per cent. American made iron pipes continue to be introduced into Canada in increasing quantities. Why not? The local manufacturers add the duty to their prices. If not, what is the duty for? and when so added why should not the consumers buy American pipes? It is the old story of keeping out importation with a tariff. The only way to secure a home market by a tariff is to over stimulate and over produce; then the struggle for this home market cuts down prices and stops importation. If this proposition does not fit every case that can be cited, then our observation has been delusive. American bar iron with a duty of $10 a ton, boiler plates, galvanized iron and other things keep overflowing the Canadian tariff dam, and will continue to do so until they are produced cheaper in Canada, or made cheaper there by an overstock.

Mr. C. P. Huntington has printed a pamphlet containing his brief before the Congressional Committee on the "Relations of the Pacific Railroad Companies to the United States Government," in which the old story appears. Mr. Huntington entirely overlooks the fact that the dispute over the subject before the committee is not with the Pacific Railways at all, but with himself and his colleagues, who absorbed a great share of the national funds appropriated to these railways. He also forgets to say what the particular functions of himself, Stanford and Crocker, were, in the work of building these

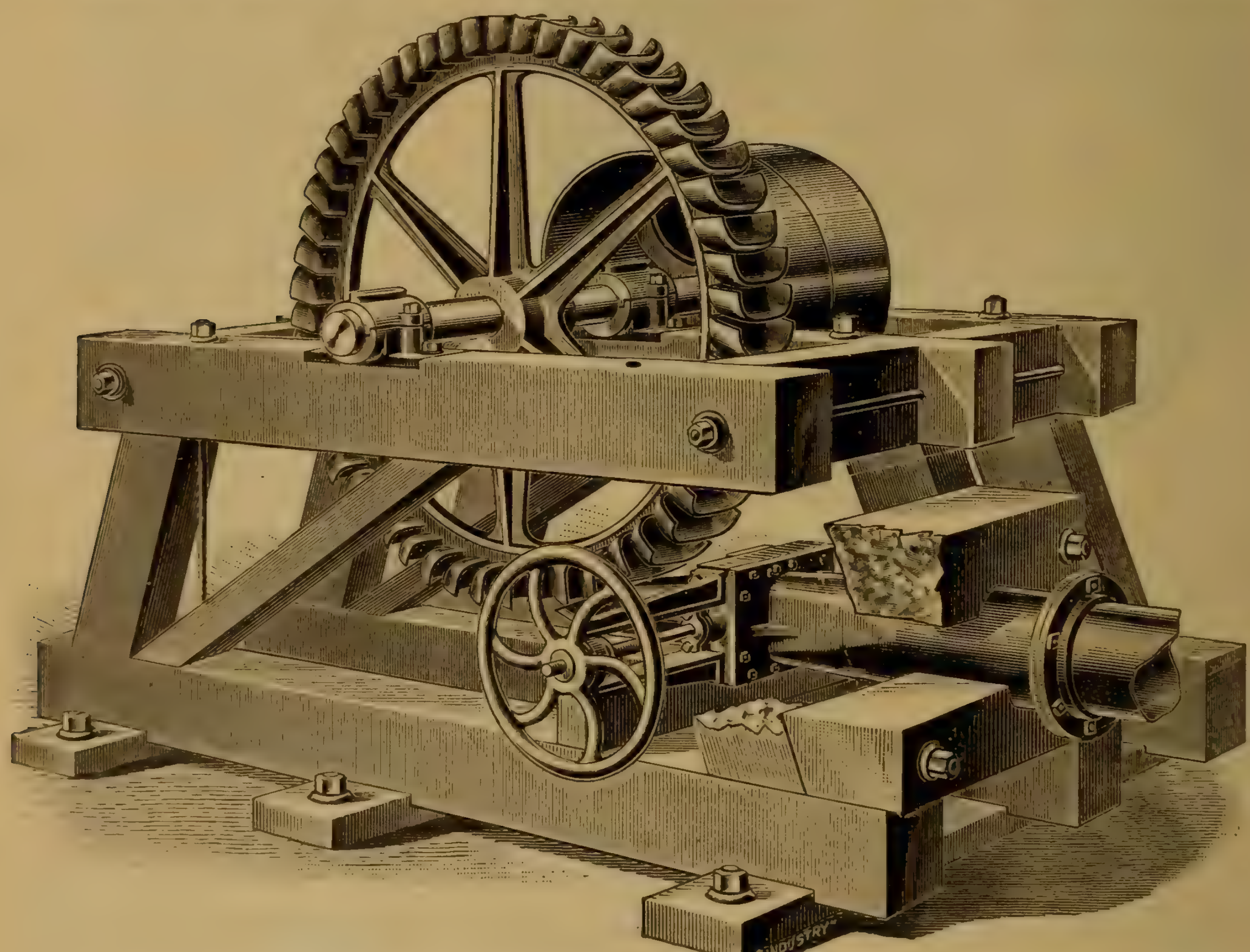
railways. Whether it was capital, skill or labor they provided, or whether it was lobby power, "Contract and Finance" aid, or what not? He argues the importance of the railways, just the same as if he and his colleagues had provided the outfit. The pamphlet is a typical production at any rate.

To constitute Mr. Huntington's brief, above noticed, anything but an evasion, it should contain some figures and statements of the amounts involved and the disposition of the funds; also should have controverted, if that were possible, the report of the Pattison Committee whose evidence was *ex-parte* and stands on record as the real facts pertaining to what he calls the "Pacific Railroads." He should also speak for his own railway, because there is no joint issue in the case other than analogy in the circumstances. As said at first, it is a re-hash of the old story with some new embellishments, and might, with slight change, be adapted to the standard of a country debating club. If it influences the Congressional Committee, it will be by acting on their "sympathies."

The Franklin Institute has 2,020 members. A "committee on sections" presented at the end of last year a recommendation to extend this system, and submitted rules for the government of the same. The subject matter is too lengthy for reproduction here, but the object is to overcome an unwieldiness common to an extensive membership, and to meet the requirements of a division into branches rendered necessary by the extent and nature of modern research. Our reason for mentioning the matter is to throw out a suggestion to the California Academy of Sciences, that by a similar method can assimilate and absorb various associations of a scientific nature in this City without in any way making complications or much increasing the cares of a central management.

Mr. Hiram Maxim, however he may be disgusted with his treatment by the government in this country, has not lost faith in American machines and implements, and a person reading a purported conversation of his, published in the *New York Sun*, may well wonder why he did not establish his gun factory here if it were not for some tariff or other trade complications that existed. The Frenchmen he considers the best "all around" mechanics in Europe,

THE
KNIGHT WATER WHEEL



The drawing above shows one of Knight's Standard Water Wheels, of which there are more than 450 in use in California alone. These wheels are made from 2 feet to 6 feet in diameter, from 10 to 1000 horse power, and adapted to all heads and to all purposes. Their first cost is less than one half as much as pressure turbines, and the expense of maintenance is not one fourth as much. Circulars with full description and particulars sent free.

KNIGHT & CO.

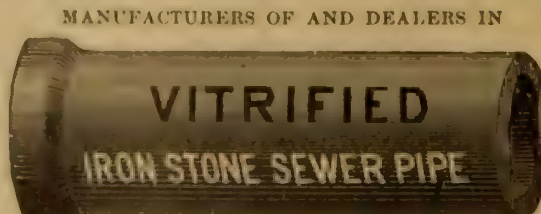
SUTTER CREEK, Amador County, Calif.

RISDON IRON WORKS, San Francisco Agents.

N. CLARK & SONS

MANUFACTURERS OF AND DEALERS IN

CAPS AND TOPS



FIRE BRICK AND FIRE CLAY

Water Pipe **Chimney Pipe**

17-19 SPEAR ST., SAN FRANCISCO

which may well be doubted. One's opinion in such matters is based on facts, and the facts are apt to corelate with one's own business. In the line of manufacture, or work in which Mr. Maxim is interested he may be right, but his gauge for a general mechanic is not to be generally accepted. He is certainly right in respect to this country in what may be called exact implements and products in metal work. We believe his guns can be contracted for here cheaper than he can make them in England.

Mr. Maxim, like many others, makes savage war on trade unions in England. This is cheap and easy, but there are two sides to this problem. The British mechanic is not so foolish as is here represented, otherwise Mr. Maxim would not employ him. The main difficulty in Mr. Maxim's case is that he is making articles not known in common use and of unknown value. The men acquire an exaggerated idea of profits, and as in other business try to secure what they deem their share. In all regular trades, trade unions are not nearly so unreasonable as Mr. Maxim here makes out, and have attained in some measure, or even in great measure, the coöperative idea, which concedes fair profits to owners as a first charge. Ownership or the capital does not there stand in the same relation to business as it does here. It may belong to the firm or company or to some one else, and interest for its use is a first charge, or as we may say, infallible charge against the business. So the workmen's interest becomes a more prominent factor when compared with what is called ownership.

The Dutch are an indefatigable people, also are very rich, and govern their country in a most admirable way. Pumping out the Zuyder (Cider) Sea is a job they have in hand just now, and will finish just as sure as the seasons come. There is a trifle of 750 square miles to be pumped dry; 25 miles of embankment to make, 200 feet wide, to accommodate highway roads, railways, and all kinds of dry traffic. The facings on the exposed sides will be of stone, and the substructure, to so call it, of willow twigs. The money to be expended is $130,000,000, which more than anything else indicates the vastness of the work. The investment will be good, and the profits enough to pay out the whole cost in a generation or two, as has other great drainage schemes in Holland.

We have received a copy of the speech of Hon. S. M. White, of California, in the United States Senate, on the annexation of the Hawaiian Islands, delivered in February last, and could easily make it the subject of some extended remarks, but will only say that it represents the views of those most able to form reasonable opinions in this matter, but the main fact is that this subject has been discussed at all in a session of Congress that seemed to have no time to do anything useful. Whatever may be the merits or demerits of the system of government existing in this country, one thing is certain; it is in no way adapted for colonial purposes, and any such attempt in Hawaii, Cuba, or elsewhere, will demonstrate this fact. It is not sober judgment that lies at the bottom of aspirations in that direction. There is a domain on this Coast, only partly conquered from Nature, that offers a sufficient field for all the pent-up energies.

The light railway craze, it may be called, that has much exercised the minds of the British people for some months past, and advanced to that orthodox stage, a parliamentary investigation, is fast dying out. We have not followed this matter, or before mentioned it, because "waiting for evidence." There is no use in filling up good space with descriptions and opinions of new things that have no logical foundation and no promise of permanence. The light railway scheme in England would call for the exercise of "eminent domain" in law terms, or in plain English the right of taking private land by the railway companies, and this is a privilege not easy to obtain in England, and is pretty sure not to be obtained. On the continent, especially in Holland and Belgium, a number of these light cheap lines have been made with good results. They are built mainly by local subscription.

F. E. Sickels, who died last month at the age of seventy-six, was notable among American inventors and mechanics. He was of German lineage, a native of New Jersey, and was the inventor of what is called trip gearing for steam engine valves, by which the induction valves are released and permitted to close independent of their connections. This is the base of the Corliss Engine so to speak, Mr. Corliss added the wrist-plate, the D valves, and other details, including as most notable, the release of the trip gearing by means of a centrifugal governor, but as said, the essential feature

was Sickels' release gearing or method, over which there was a long and bitter contest in the United States Courts. At the Centennial Exhibition in 1876, an award was made to Mr. Sickels for his inventions. This award was suppressed by a revision committee of which Mr. Corliss was chairman, no doubt through personal objects. Mr. Sickels was at one time chief engineer of the Union Pacific Railway.

The death of Col. F. A. Seeley, in February last, left in the United States Patent Office a void not easily filled. It is seldom that a man of Col. Seeley's attainments has been willing to accept a position that isolated him from the world and its business. He was a Principal Examiner in the Patent Office, having cognizance of intricate cases, especially of an electrical nature. Col. Seeley, if we remember correctly, was with Horace Greeley and some others, identified with the very earliest attempts at electric lighting in this country, and was an authority in all matters pertaining to electrical matters. His principal connection with the department, was, however, in dealing with international patent and trade-mark laws, acting as an adviser not only to the Commissioner of Patents, but also to the various government departments where problems in patent and trade-mark laws were considered.

All over the land, or at least over most of it, there is excitement and promotion for still farther widening the suffrage system, by permitting women to vote. The desire to do so is something no one can account for, except on the principle of there being, as in Ireland, a natural need of a "grievance." The aggressive woman of our time, and we may say of our country, has become a nuisance. We do not mean those who have on logical grounds demanded and have attained equal rights before the law in all matters pertaining to education, property and other conditions; but voting, politics and public administration, had better be left alone the same as other obtrusive vices of our age. The woman who wants to "do whatever the men do" should be compelled to, and that would soon call out a cry for exemption, in all but the "easy parts."

We have in this State a good deal to say respecting irrigation, but if the county surveyor of Yakima County, in Washington, is correct in his figures, that county must be ahead of any like district in this

State. There are nineteen ditches with a total length of 383 miles, conveying 105,840 cubic feet per minute, watering 139,410 acres. The cost of construction is set down at $3,075,000, and the expense per acre varies all the way from $0.66 to $21.00, the average being about $8.00 per acre. The whole area to be served, "reclaimed" it is called, amounts to more than 400,000 acres. The area now cultivated is only 69,520 acres. These are no doubt, paper estimates, but with all allowances it seems a lot of irrigation in a country supposed to be well watered by rains.

The Mexican International Exposition to be held next year, will be in keeping with the progressive spirit of the Diaz Government, and without doubt of much use to Mexico. The various provisions and concessions now reported are of a liberal nature. The ground to be occupied embraces over 500 acres, near to the city and susceptible of complete improvement for the purpose. There will be a large number of both exhibitors and visitors from this Coast, and it is not too soon to consider the subject at this time. There has been formed here an exhibition company to take charge of the matter of exhibits from all parts of the United States, called the American-Mexican Exhibition Company, of which Consul General A. K. Coney, of this City, is the president. This company is incorporated under the laws of this State, and has its head office at 604 Clay Street in this City. The scheme of such a company is decidedly novel, and it seems to present a considerable advantage in several ways. It is proposed that branches or separate companies acting under the main one here be formed in various parts of the country, each electing its own officers. Farther information can be procured by addressing the president at the address given above.

On all sides during last month comes news of an increasing volume of trade and manufacture. These times of depression come in periods of about twelve years, and although they are much alike, no one seems to comprehend from one time to the other that hard times require a period for recuperation in proportion to their intensity. Two years ago it was common to hear people remark that in a month or two trade would revive, but causes that have been at work for ten years are not removed in a month or two. The fact is, that financial confidence when once shaken takes years to recover, and the

☞ EDITION NEARLY EXHAUSTED.

CENTRIFUGAL PUMPS

Construction, Operation, History and Examples.

BY JOHN RICHARDS.

TWENTY-THREE ILLUSTRATIONS.

In Cloth Binding, postpaid *$1.00*

CONTENTS.

SECTION I.—CONSTRUCTION AND OPERATION.

SECTION II.—HISTORY OF CENTRIFUGAL PUMPS.

SECTION III.—APPENDIX.

INDUSTRIAL PUBLISHING CO.

40 CALIFORNIA ST., SAN FRANCISCO.

GERMAN LEARNED IN ONE MONTH. THE Rote Lexicon. Price 25c. THE INDUSTRIAL PUBLISHING Co., 40 California St., San Francisco.

channels of trade once blocked cannot be cleared until the penalty for violated commercial laws is paid in full. The causes are inscrutable. The problem is, which out of many, is the chief one? No one knows, and if they did, there is no quick remedy. We have now began to ascend again. The grade is long, but we are surely ascending.

Engineering Notes.

It is common at this day to begin the education of young mechanics and engineers with the equilibrium of kinetic forces, but the theory gets some severe jogs now and then. Some inventor with no fear of physical laws, has set up an auto-acting machine, vulgarly called a "perpetual motion," in this City, which is going even now, and no one can tell why it goes, how it goes, or why it should not go. It is not serious as a window attraction, but there are other and more extensive attacks upon the equilibrium of forces. A Mr. Taylor, of Montreal, Canada, has invented a "Tromp" machine, for compressing air with a water-fall, by means of which the amount of power generated is irrespective of the head of water, so long as there is a hole sunk in the ground deep enough to attain a fall in proportion to the power required. This latter invention we propose to deal with again, and mention it now only to show the trend of things.

The German engineers keep on improving their gas-driven street railway engines, and with much promise. A main objection, that of the odor from the burning oil, is now avoided by placing the engines beneath the seats, with access only from the outside. The weight of the locomotive cars at Dessau is with cooling water and all supplies, only six tons, to carry twenty-eight people, which is a reasonable weight. The engines when at work, run at 250 revolutions per minute, and when free or unloaded at 80. One feature of note is that the brake apparatus is so constructed, that a car moving at 7½ miles an hour is stopped within a distance of 16 feet. This brake matter will have to be regulated in some way by law in this country; penalties and damages will not prevent accidents caused by the want of brake power. Such penalties are constantly evaded.

The ponderous article on technical subjects, was in former times a work of labor, tedious, but true and exhaustive. Now it has become a delusion, because rarely more than generalization and a "summing up." We write this at the end of an attempt to wade through a long laboratory article on high speed engines, in which it is stated that single acting engines "are usually made with their cylinders," which happens to be not true, but the main fault is the treatment of the subject from a thermal point alone, and neglecting the mechanical problems in the case, also adaptation, both of which conditions must be included in any complete essay on high speed engines. Figuring on heat problems is well enough, but so long as a principal cause of high speed is to secure regulation, the mechanics of the problem is certainly as important as anything else, and the most practical one to deal with.

The Hon. A. C. Parsons, now the principal engineer of the world, in the line of impulse steam engines, and almost a sole maker of these, has been preparing and patenting plans of applying his turbines to propelling vessels, and we imagine will find most of his labor useless in the future. If ever the turbine engines are employed for propelling vessels, and they are sure to be, such application will naturally consist in gearing them to the ordinary impelling apparatus now in use. We do not need any other, and it is a branch of engineering that involves as many problems as the impulse engine. From a recent patent of Mr. Parsons, it seems that he provides for short pitch screws at high velocity, hydraulic thrust bearings and other contrivances, that need form no part of a straightforward application of his engines to screw and paddle shafts.

A foreign contemporary, commenting on those peculiar vessels called in this country "whale backs," says the spar deck or navigating platform of the vessel is wanting; the hatches without combing are inconvenient for loading bulk cargo; the mid-ship section is weak, because there are no gunwales to resist sagging strains; the spoon-bow hammers the seas, or the seas hammer that, and the forefoot being cut away makes bad steering. These are not the words of the writer, but the same thing will be found in substance in the early numbers of "INDUSTRY." The *Wetmore* hammered herself to

MORISON SUSPENSION FURNACES

FOR

LAND AND MARINE BOILERS

Uniform Thickness **Easily Cleaned**

UNEXCELLED FOR STRENGTH

MADE BY

THE CONTINENTAL IRON WORKS

P. O. Station G. BROOKLYN, N. Y.

INCORPORATED 1866

Insures against Damage to Property, Loss of Life, and Personal Injury

CAUSED BY

STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

CHARTER PERPETUAL

J. B. PIERCE, Secretary
J. M. ALLEN, President

ABSTRACT OF STATEMENT
JAN. 1, 1895

Cash Capital,	$500,000.00
Total Assets,	1,955,255.24
Surplus as to Policy-Holders,	693,726.15

PACIFIC COAST DEPARTMENT

MANN & WILSON, General Agents

J. B. WARNER, Chief Inspector

306 Sansome Street, - San Francisco, Cal.

pieces on this Coast, as must any vessel that presents a surface nearly flat to a meeting sea. We believe the whole matter to be a fallacy in so far as deep-sea traffic, as time will no doubt prove.

It is the custom to advertise for plans and estimates, and tenders for public works, sometimes with an offer to pay some ridiculously small premium for two or three of the best schemes presented. Just now the Montreal Bridge Company is doing so, and the object is to secure plans without expense or nearly so; altogether so, when there is a tender for the work included. The same custom exists in respect to machinery; it being common to ask for plans, estimates and tenders from various firms, the plans being included or conceded in the cost of the successful bidder for the work. In neither case is this a fair way to proceed, because the losses are entailed on competitors, also because the best plan may be submitted by the firm least able to perform the work, and *vice versa.* If competing plans are invited a certain number should be called for, or what is better, certain people or firms asked to submit plans in competition. In the older countries where experience is greater, advertising for "plans" has been abandoned.

ELECTRICITY.

The General Electric Company seems to be making a "sweep" with their "three-phase" system, and have collected a number of letters written by clients supplied with plants operating in this method. One case at Sewall's Falls in New Hampshire, from where 500 kilowatts of current is generated and conducted to the City of Concord four miles distant, to be distributed for power and lighting. This was the first case of adopting the tri-phase system for an installation of the kind, but since followed in a large number of cases with complete success. These changes and inventions of a fundamental nature presents to the minds of those, not electricians, the view that the subject is far from exhausted and that other improvements are in prospect. Then again, when one considers the exhaustive experimental and other data collected by such a corps as that of the General Electric Company, it must seem that we have nearly "settled down."

The people of Canandaigua, New York, have arranged a pumping station in the lake to be driven by an electric motor, the power being conveyed from a steam engine more than three miles away. The motor will be of 100 horse power with a current of 2,080 volts from a three-phase generator made by the General Electric Company, who furnish the whole of the electrical equipment. There will be two pumps to supply one million gallons daily, geared directly to the motor, which is to run at 600 revolutions per minute. This forms an excellent plan of getting out into a lake for water, by placing the power plant on the shore, with the motors and pumps at the intake.

A new accumulator battery has been brought out in Germany, called the Schafer-Heinemann one, that if reports are true is another step in advance for the storage system. In competitive tests the cost of propelling street cars by these batteries is as 9 to 11.5 against the trolley system, and as 1 to 3 compared with horse traction. There is a long dissertation on the chemical reactions and theory of the batteries, which we have no room to recite, but that the matter is well worked out the computations show in the fullest manner. Mr. A. M. Gilson contributes a long article on the subject in the *Engineering and Mining Journal* of Feb. 16th, of this year, and an inquiry addressed to the editor or to Mr. Gilson will no doubt elicit full information respecting this new German invention.

Mr. H. W. Leonard's paper on "European Electrical Engineering," which we noticed last month, describes at some length what seems to be a just system of distribution, and describes the districting of the City of London, and alloting defined limits to certain companies in which they shall supply current. Such an arrangement requires control by the authorities, otherwise oppressive rates would soon follow. It is infinitely better than competition, which is expensive, and its cost is naturally saddled on the consumer.

Mr. Leonard's observations on the Heilman locomotive, which he examined, few mechanical engineers in this country will agree with. The general objection of concentrating a mass of interdependent machinery like this, whatever particular advantages may be gained is not in the line of modern improvement, but the reverse,.

C. W. HANSEN A. BAIN

SAN FRANCISCO STOVE WORKS

MANUFACTURERS OF

STOVES, RANGES

And all kinds of Light and Smooth Castings

622, 624, 626 Third Street, S. F.

W. O. FASSETT P. R. FASSETT

S. F. BLUE PRINT CO.

Printing from LARGE TRACINGS a Specialty

FRAME 84 X 44 INCHES

St. Ann's Building, 6 Eddy St., S. F.

Room 109.

C. W. PENNINGTON & SONS' STEEL WORKS

MANUFACTURERS OF

Best Refined Cast Tool Steel. Machinery and Hammer Steel, Steel Piston Rods, Steamboat Shafts, Dredger Buckets, Shear Blades, Lathe Spindles, and all kinds of Steel Forgings made to order.

Office and Works:

218-220 Folsom St. S. F. Cal.

O. Rolfson. **R. J. Rolfson.**

ROLFSON BROS.

423 Bay Street

Inventors will find it to their advantage to consult Mr. R. J. ROLFSON.

Draughtsmen, Model Makers and Machinists.

EDWARD S. COBB

Mechanical Engineer and Expert

Tests and Estimates for the Improvement of Pumping, Power or Hydraulic Plants. Will Supervise the Construction, Shipment or Erection of Machinery.

Drawings, Estimates or Specifications.

Prices Obtained for Machinery of Every Description. Twenty Years Experience.

23 Davis St., Rooms 30-31, San Francisco, Cal.

A. E. CHODZKO

MECHANICAL ENGINEER

Air Machinery a Specialty

226 Market St., Room 3, San Francisco

P. O. Box 1914

C. T. CLEVE W. H. REED

REED & CLEVE

PATTERN MAKERS

Patterns and Models of Every Description. **Machine Patterns a Specialty.** Drawings and Estimates Furnished. All work done with neatness and dispatch. **Telephone No. 5108.**

225 First St. San Francisco.

A. A. MCDEARMON F. MALLOYE

McDEARMON & CO.

ASBESTOS

Boiler and Steam Pipe Coverings

Asbestos Cemenf for Boilers, Drums, Heaters, Etc.

H. W. JOHNS CO'S. SECTIONAL COVERINGS

43 Ninth Floor, Mills Building, San Francisco.

Send for Circulars and Prices.

Established 1862.

THE CALIFORNIA TOOL WORKS

J. WEICHHART, Proprietor.

MACHINISTS AND BLACKSMITHS,

MODEL AND DIE MAKERS.

Steel, Iron and Brass Work. Special Tools and Machinery for all trades made to order.

Repairing in all its Branches. All work Warranted.

Telephone Main 1356.

143-145 BEALE ST., Near Howard, San Francisco.

---

31 Main St., San Francisco. 85 First St., Portland, Or.

SIMONDS SAW COMPANY

SAWS and MACHINE KNIVES

Leather Belting	**Rubber Belting**
Dodge Wood Split Pulleys	**Hose Packing**
Emery Wheels	**Cotton Waste**

Mining and Logging Supplies

SMITH & YOUNC

BUILDING SUPPLIES

230½ South Spring St., Los Angeles. Cal. **723 Market St., S. F., Cal.**

Specialities.—Blue Print Paper; Casing Blocks; Deadening Felt; Infusorial Earth; Lamps, Buckeye Incandescent; Bostwick Steel Lathe; Marble; Mineral Wood; Mouldings, Turned Art; Paints, Plumbago and Malthine; Pecora Mortar Stains; Roofing; Sheathing Papers; Sash Balance and Lock, Combined; Shingle Stains; Soapstone; Spiral Balusters; Wood Carvings and Ornaments.

VAN DUZEN STEAM JET PUMPS

THE BEST IN THE WORLD.

Pumps any kind of Liquid. Always in order. Never clogs nor freezes. Fully Guaranteed COST $7 AND UPWARD Especially useful for Mines Quarries, Pits, Wells, Clay Pits, Breweries, on Steamships, Ferryboats or any place where steam is available and liquid to be pumped. A full supply in stock. Address,

JAS LINFORTH, 37 Market St., San Francisco

but taken as a whole one must admit that Mr. Leonard is the most impartial "traveler" that has reported on electrical matters abroad. In the March meeting of the American Institute of Electrical Engineers this paper was dicussed at length by a number of members, and brought out a criticism we had foreseen by the title of "European practice," when the writer had been only in England and France. Germany and Switzerland would have added a good deal to his notes no doubt.

MINING.

NOTES.

The Risdon Iron Works, after making for many years, the Bryan ore crushing machine, have summed up their experience and that of their clients, and re-constructed the machine. It is difficult without the aid of geometrical drawings to describe the changes made, but they are important. The screen surface has been increased, the rollers are removable from the side, and the driving mechanism has been detached from the rollers, so that it is not affected by their variations of position, and the first mover or driving shaft is placed in a horizontal position. The Bryan machines were before very successful, and under this new modification will no doubt meet with a still more extended use. The power consumed is said to be only one fourth of a horse power to each ton crushed per day.

In the great Simplon Tunnel the drilling is to be done by water power, and rotary drills employed. The contractors have previously used such drills, and prefer them in this case. The driving power is derived from two small hydraulic engines with cranks attached at a right angle, turning a worm gear that meshes into a tangent wheel on the drill stem or spindle. It seems a rather clumsy arrangement, and would be inapplicable in most mines, because of the water discharged and lack of air provided by pneumatic machines. The construction of the hydraulic apparatus by Messrs. Sulzer Bros. is a study. The engines operate on the duplex system, one forming a valve for the other, like the Worthington water meter. There may be cases in California where such drilling apparatus would be suitable, and information can be procured from the firm above named at Winterthur, Switzerland.

The tricks of mining speculators and of the mining business generally have become proverbial, but, as a matter of fact, mining is an exemplary industry in respect to cheating if compared with a good many other things that do not offer a tithe of the temptation that mining does. The reported sales of mines for prices measured in the millions is a harmless kind of humor indulged in by the journalistic man, but people soon come to understand that a divisor of form is a "constant" in these reports and no one is injured. As a matter of fact no kind of property changes hands at this day with a nearer approach to *quid pro quo* than mines do. The securities listed on the stock exchanges, railway, electric and other, are no better if as good as mining shares. This cannot be claimed for former times, but during the last two years the transfer of mining property in California has been conducted with remarkably good faith.

Speaking of speculation in mining shares, the art seems to have been transferred from Pine Street to the staid cities of the old world, proving that human credibility is much the same everywhere. In Paris at this time, the Kaffir mines are being exploited in a way to bring out the "stockings" that have been filled again since their depletion by De Lesseps. In London it is estimated that a thousand firms are engaged in the mining-share broker business, and the police have found it necessary to clear the streets which were blockaded up to six o'clock in the evening. We can well mind fifteen years ago, when, as a stranger, we watched the crowd of speculators in this City and thought that would be the last. Away out here on this fringe of the continent, one might expect the end, but it did not end, and now is as rife in the old world as it is absent here.

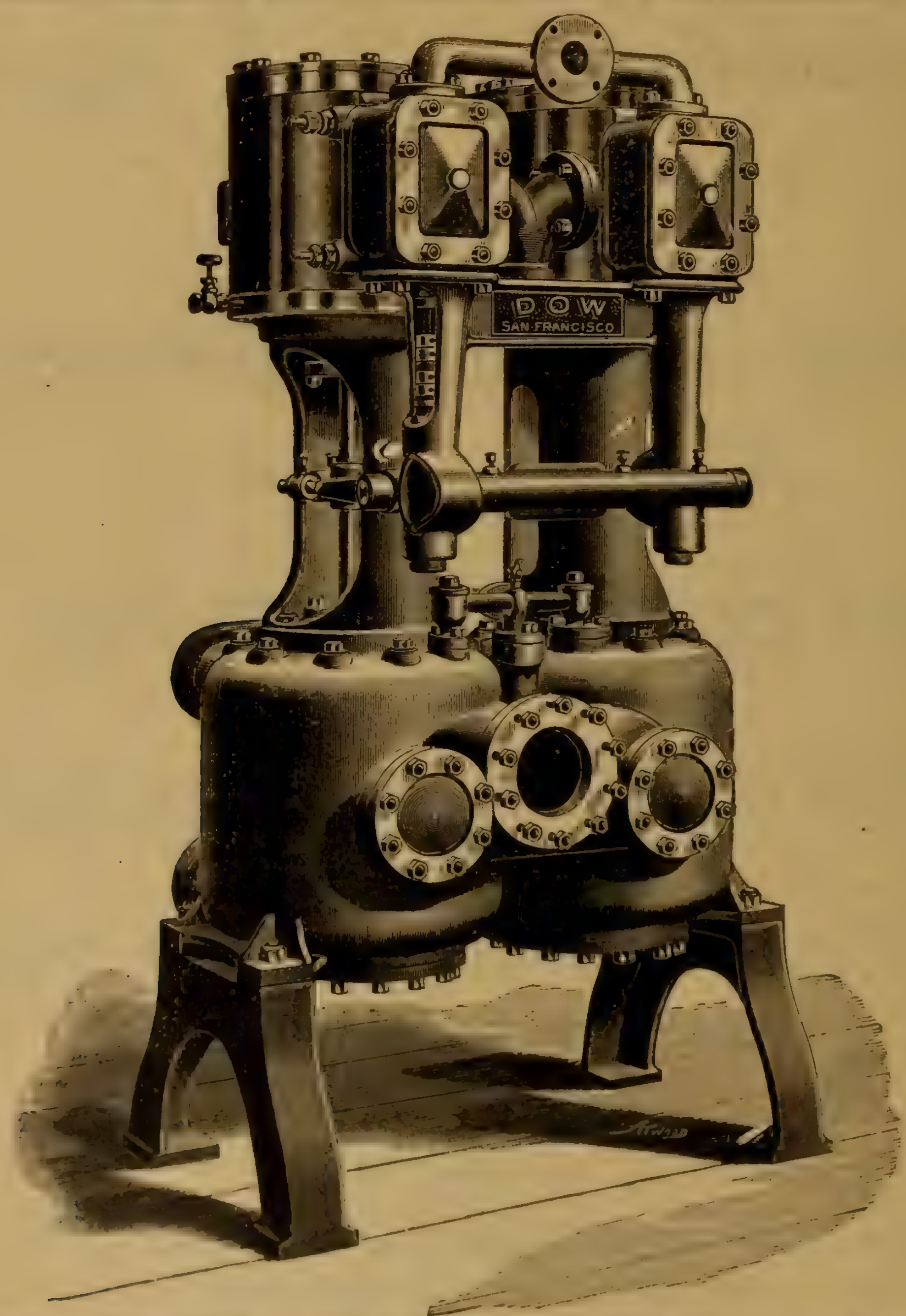
Colorado is to have a Mining Bureau, and in looking over a digest of the Act establishing such a Bureau, it seems to be copied very nearly after the one in this State, and is wholly like it in the omission of a provision requiring a list of mines. This is the most useful function a Mining Bureau can perform, and it is hard to see why it is not included in the requirements. Laws to regulate the duties of public officers in what may be called the technical departments of government are apt to be vague and indefinite, as in the case of the Act of Congress that created the United States Geological Survey. The purpose was to confine the duties of this Bureau to the govern-

DOW STEAM PUMP WORKS

MANUFACTURERS OF

DOW'S PATENT STEAM PUMPS

FOR EVERY POSSIBLE DUTY. ADOPTED ON U. S. GOVERNMENT VESSELS.



COMPOUND PUMPING ENGINES

THREE PLUNGER PUMPS
Run by Electric Motor or Gas Engine
FOR ELEVATORS, ETC.

POWER PUMPING MACHINERY
For Every Possible Duty.

IMPROVED FIRE PUMPS
For Hotels, Saw Mills and Public Buildings.

VERTICAL AIR PUMPS
For Marine and Stationary Engines.

Pumps for Breweries
Wineries; Chemical, Gas, and Vinegar Works, etc.

Speed Governors, Pressure Regulators and Balance Valves, for Steam Pumps, etc.

Correspondence Solicited. Send for Catalogue.

OFFICE and WORKS, 114-116 BEALE ST., SAN FRANCISCO

ment lands, which is indeed the only land the government has any right to deal with, but the Commission soon found a way out of the provisions and included the whole United States and part of Europe in their field of operations.

There is now being considered a scheme for holding in Denver, Colorado, an International Mining Exhibition similar to, but more extensive than the former one in the same city about ten years ago. Without intimating that the people there do not best know their own business, we will suggest that the international feature will lead into a great deal of useless expense without any commensurate gain, and an exhibition of narrower pretensions will do as much good with a much smaller investment. The entries could be open to the world, but promotion abroad and the machinery of an universal exhibition will make a draught on resources which, for these times, even in Colorado, will hardly be borne. The former exhibition in Denver evidently contributed a good deal to the prosperity and regulation of the State. Denver is, geographically, a center for an exposition of the kind.

Miscellaneous Notes.

The astute makers of bicycles discovered long ago that the number of these implements that would come into use depended on the quality of the roads, and one of the chief makers published a serial on this subject, so that the "wheel," as it is called, has a public mission as well as promise of a personal one, wider than all other wheel traffic combined. What it is finally to become as a feature of our future economy begins now to appear, and in its history is a lesson that mechanics should observe. It has taken thirty years of hard pressed evolution to produce a modern bicycle, and the end is not yet. The mechanics of the problem has now attained a dignity that calls for treatment in the leading technical journals of both this country and Europe.

U. S. Consul W. P. Roberts, at Victoria, B. C., furnishes the State Department with a report on the seal catch of 1894, showing sixty-one Canadian vessels in that business, and a total of 94,474 seals killed. Of these 11,705 males and 14,636 females were killed

in the Behring Sea, the rest were caught on the British Columbian coast, the coast of Japan, and around Copper Island. The number of seals to each vessel was about one thousand, the remainder of the total being made up by what the Indians captured in canoes. This is fearful slaughter for one country, and is 24,000 more than the Canadian fleet captured in 1893. Only two vessels were seized, and these were at once released on "showing."

The discovery of a new element in the atmosphere is a most surprising event, that in the minds of most people must cast some doubts upon the precision of analysis. This new element, called "argon," is thus described in chemical terms: critical point, 121 degrees; critical pressure, 50.6 atmospheres; boiling point, 187 degrees; melting point, 189.6 degrees; density, 1.5. The reactions are not known, further than a long list of substances with which no combination is possible. The whole scientific world is now at work upon "argon," and more will soon be known of its nature.

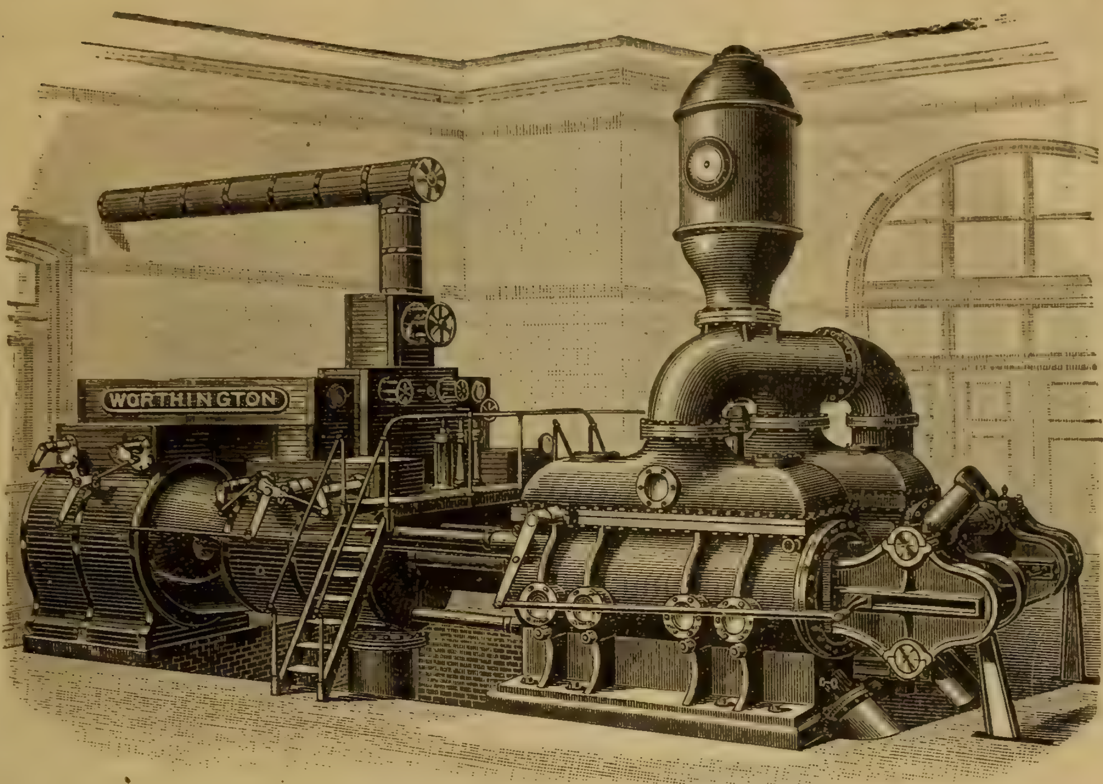
The Department of Agriculture, at Washington, in a recent report shows a decline of prices in farm products that has been estimated at more than $300,000,000 for 1894. The decline in wheat alone is about $88,000,000, and $10,000,000 in cotton. In 1880 cotton brought 11 cents, and now it is worth less than 5 cents a pound. Wheat is 50 cents a bushel, or nearly 50 per cent. less than for three years preceding. Other products, most of them, in proportion, but even this is not a measure of the fall in land values, because the "profit" on products has disappeared, and that is what determines the value of land. Unless prices of farm products advance, or other prices decline accordingly, land will have no value at all, except a prospective one.

United States Commercial Agent Geo. H. Murphy, writing to the State Department, in October last, on wages in Luxemburg, says:

"The policy of the countries of central Europe seems to be to extend and inflate their manufacturing industries indefinitely. Their idea of national prosperity and happiness seems to be nothing more than the attainment of the ability to export manufactures and to import food. In support of this policy, in many cases the governments of different central European States take from the workingmen an import duty on his food in order to give to the manufacturer

WORTHINGTON HIGH DUTY PUMPING ENGINES

THESE HIGH DUTY PUMPING ENGINES Have been adopted by the World's Fair Commission to supply all buildings and grounds of Columbian Exposition, Chicago 1893.



THE CONTRACT CAPACITY of Worthington Pumping Engines for Water Works alone to Jan. 1, 1892, 2,585,000,000 Gallons daily, which would afford a stream of water 12 hours per day, 400 feet wide, 5 feet deep, with a current 3.4 miles per hour.

Pumps for all purposes and for any pressure to 8,000 pounds per square inch. The pumps in the Mills Building, Crocker Building, Chronicle Building, Donohue Building, Union Foundry Block, First National Bank Building, Telephone Building, Lick House, Occidental Hotel, and many others in San Francisco, are Worthington.

A. L. FISH, AGENT, 59 AND 61 FIRST ST., S. F.

ALSO AGENT FOR THE

AMERICAN FIRE ENGINE Co., which includes Clapp & Jones, Silsby, Ahrens & Button Engines

BUCKEYE AUTOMATIC CUT-OFF ENGINES, of Salem, Ohio

CURTIS' STEAM AND WATER PRESSURE REGULATORS

NATIONAL WATER PURIFYING CO.'S FILTERS

Water and Gas Works' Converse Patent Lock-Joint

PIPE

Extensively used in Cities and Towns on the Pacific Coast, for Heavy Pressure, Durability, Economy.

Gates, Fire Hydrants, and Full Supply Pipe Fittings and Tools

DUNHAM, CARRIGAN & HAYDEN CO.

AGENTS

17 and 19 Beale Street 18 to 24 Main Street

SAN FRANCISCO.

an export bounty. The much talked-of disarmament of Europe will if it ever be realized bring further calamity to the working classes; for it will bring into the labor markets millions of young men who have been unfitted for country life by several years residence in city barracks.''

The raising of certain portions of the earth's surface, and the sinking of other portions, will soon become something more than a curious geological fact. In this country two notable cases are the region of Lake Erie and Ontario, which are rising, and the country about the mouth of the Hudson River is sinking. In an article on the geology of coal in the *Colliery Engineer*, it is said that a large portion of Jersey City, opposite New York, has sunk below the water, and that complete inundation can be expected in 300 years, and that both Jersey City and Newark are not more than two feet above the water now. A more portentious event predicted is the reversal of the drainage system of the Great Lakes, caused by the land raising in the region of Lake Erie, and turning the waters back to the Mississippi Valley. New Jersey is estimated to be sinking one foot each fifty years.

The Blue Lakes Water Company, in Amador County, have a canal about ninety miles long. The main branch taps the Mokelumne River about twenty miles beyond Sutter Creek. The ditch is six feet wide at the bottom, nine feet at the top, and three and a half feet deep, with a fall of eight feet to a mile. The supply from the Mokelumne River is supplemented by the Blue Lakes in Alpine County, which are damned, and drawn off to keep the summer supply constant. The water from the lakes flows sixty miles in a natural channel before entering the canal. The water from this canal supplies nearly the whole of the Mother Lode mines at Amador, Sutter Creek, Plymouth, Jackson, Ione and other places. The cost of the work has been about $1,300,000, represented by 25,000 shares of $100 each.

A contemporary says, " No one has been able to determine the cost of producing an ounce of gold " This is certainly true in so far as statistical research, but we have happily a better gauge than statistics, that is the ''price'' of an ounce of gold, which is a very true measure of the cost of production, less a margin that must be allowed for the speculative allurement of searching for it. There is

no reason why gold should have a gauge of value different from iron, copper, lead or tin, except that its use for money and, as we said, the fascination of its procuration influences such values, and these things do not change it much. No other metal or commodity has been found and procured under such regular conditions as to cost or expense, and no other is so universely diffused, so its value or its cost has remained the most constant of all things.

The Brooklyn electric railway companies have violated the laws relating to stock inflation, in respect to the hours of labor, and the speed of their cars. The New York *Tribune* says it cannot be denied that they have used the people they employ with conspicuous unfairness, injustice and oppression. Now all this does not warrant lawless acts on the part of strikers, but when the strike is done the circumstances call for a prompt investigation of the corporations. The fact is that these banded companies have quick and effectual aid from the authorities whenever there is infraction of the law against the lines or its business, but there is very tardy action when the laws are infracted the other way, or on the other side. Here in San Francisco the ordinance in respect to the speed of street cars is continually violated to save service. The ordinance regulating this should be enforced or repealed.

No. 83. JUNE, 1895. Per Year, - $2.00
Single Copies, .20

INDUSTRY

A MONTHLY MAGAZINE

DEVOTED TO SCIENCE, ENGINEERING AND MECHANIC ARTS

ESPECIALLY ON THE PACIFIC COAST.

JOHN RICHARDS, Editor Founded 1888. W. D. BENT, Jr., Business Manager

CONTENTS

Registered as Second-Class Matter at the Post Office, San Francisco.

Industrial Publishing Company, 40 California Street, San Francisco.

INDEX TO ADVERTISEMENTS.

WASHBURN & MOEN M'F'G. CO.

WORKS:

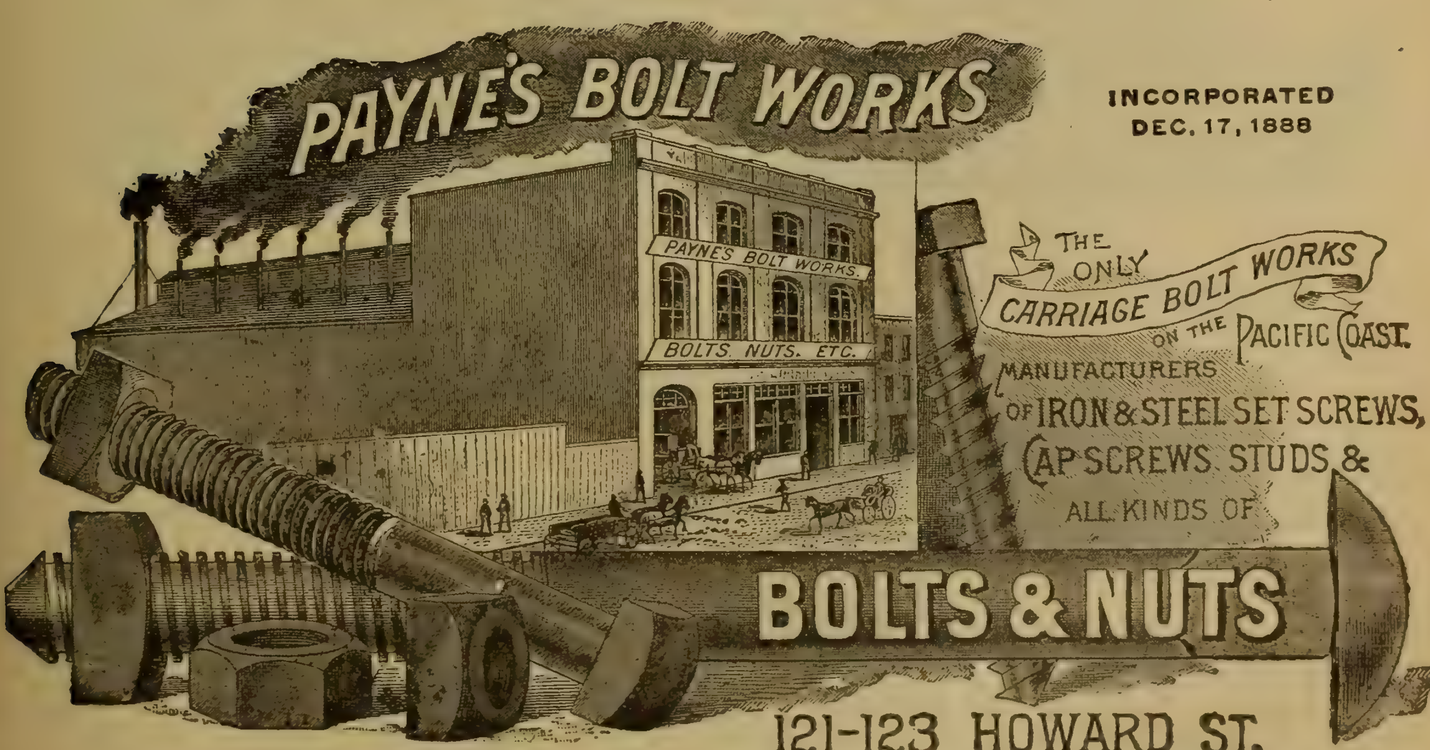
WORCESTER, MASS. WAUKEGAN, ILL.

BARBED WIRE.
BALE TIES.
WIRE ROPE.

IRON AND COPPER
BARE AND INSULATED
ELECTRICAL WIRES.
WIRE SPRINGS.

SAN FRANCISCO
OFFICE AND WAREHOUSE: **8 and 10 Pine Street.**

FRANK L. BROWN, Pacific Coast Agent.



Upset Bridge Rods, Truss Rods and Anchors, Turnbuckles, Head and Point Drift Bolts, Wine Cask Bolts with Brass Acorn Nuts, Cold Punched Square and Hexagon Nuts.

All Kinds of General and Special Blacksmithing

"INDUSTRY."

JOHN RICHARDS, EDITOR.

ISSUED MONTHLY BY THE

INDUSTRIAL PUBLISHING COMPANY

SAN FRANCISCO.

FOUNDED 1888. JUNE, 1895. No. 83

STERN TUNNELS OF THE OLYMPIA.

A CRITICISM AND REPLY THERETO.

The following remarks, next below, found in a contemporary, were sent to Mr. G. W. Dickie, manager of the Union Iron Works, and the designer of the stern tubes referred to, for any explanation he might desire to make. We reprint the original article with Mr. Dickie's remarks, so the whole subject will be made plain. There may be people competent to criticise Mr. Dickie's engineering practice, but evidently the writer in this case is not included among the number.

"The following reflections have been suggested by an examination of drawings, showing the method adopted for enclosing and supporting outboard ends of the screw shafts of the United States cruiser *Olympia*, built by the Union Iron Works, San Francisco, Cal.:

In that vessel, the outboard ends of the screw shafts for a length of 24 feet (the distance between the forward end of the stern bearings and the stuffing boxes through which the shafts emerge from the hull of the ship) are enclosed in tubes 3 feet 9 inches internal diameter at their forward ends, and 2 feet 10 inches where they join the stern bearings. Each of these tubes is made of steel one half an inch thick, and is connected to the hull throughout its length by a box or cell formed of steel plates three eighths of an inch thick, stiffened with angle irons. This box has an average depth

(measured on a line approximately parallel with the outside of the hull) of 3 feet 10 inches at its forward end, and 6 inches at the forward part of the stern bearing. It will, therefore be evident, that this cellular connecting box tapers at a much more rapid rate than the tube which it supports. This is done probably to afford the water as free a run to the screws as possible, but this intention is in no small degree defeated by the fact that the bracket arms which support the stern bearing are attached to the hull at points considerably above and below the after thin end of the cellular structure referred to, and have to be dragged through the water, and must, by whatever resistance they oppose, impair the speed of the ship.

These brackets, it is true, are quite similar to those in common use for many years for the support of the stern bearings of twin screw shafts, and if there were no better method of accomplishing such support, criticism would have no claim against them; but, as it is well known, there is a better way of attaining the end sought, and, therefore, in a cruiser whose speed at a critical time may involve her own safety and that of her personnel, such improved methods should have been adopted.

The steel tubes above mentioned as enclosing the shafts are, strange to say, not water tight, but on the contrary are filled with water, the presence of which seems to have required the casing of the shafts (which are of steel 16 inches in diameter) with a bronze tube (closely fitting it) 1 inch in thickness and 31 feet in length. The weight of each of these bronze casing tubes is about 6,000 pounds; furthermore, the water which surrounds each shaft will weigh at least 10,000 pounds, which, added to the weight of the bronze casings of the shafts, makes a weight of 16,000 pounds on each side of the stern of this ship, or 32,000 pounds in all of load, which must be sustained and dragged through the water, and consume power for no useful purpose whatever; moreover, in the pitching and rolling of the ship, this useless dead weight subjects the vessel to strains which are totally unnecessary, and which the adoption of modern practice would have avoided.

Just why this faulty construction has been adopted by the navy department is not evident. There are rumors that some of the other new vessels are to be built in the same way. It is well known that there are several vessels afloat in which the tubes enclosing the screw shafts are accessible from the interior of the ship throughout their length up to the forward end of the stern bearing, where the stuffing box is placed. This construction makes it unnecessary to encase the shafts with bronze, and allows for their examination at any time. By this construction the extra buoyancy due to the displacement of the shaft tubes is secured, and there is, of course, no strain on the vessel due to a mass of dead weight.

This construction is no experiment, but has been used for several years, and so satisfactory has it been found, that the Cramp Company has adopted it for the new American liners *St. Louis* and

St. Paul. In view of what has been done in the matter of shaft tunnels for twin screw vessels, it does seem that the navy department took a step (if not a tumble) backward, when it enclosed the shafts of the *Olympia* with tubes filled with water."—*Scientific American.*

STERN TUBES OF THE U. S. S. OLYMPIA.

BY G. W. DICKIE, MANAGER OF THE UNION IRON WORKS, SAN FRANCISCO.

My attention having been called to an article published in the *Marine Review* of April 18th, taken from the *Scientific American*, under the title of "Stern Tunnels of the *Olympia*," I have concluded to reply to this article in the pages of "INDUSTRY," as being the representative magazine of engineering thought and practice on the Pacific Coast.

The *Olympia* having passed from the hands of her builders into the United States Navy, there is now no reason why those who have had a prominent part in her construction should permit such articles, apparently written for the purpose of misleading those not conversant with the facts, to go unanswered.

With the statement of facts and sizes given in the article, I have not much fault to find, and I will simply correct them before taking up the other points of the writer above mentioned.

The diameter of the stern tube is given at 3 feet 9 inches at the forward end, it should be 3 feet 7¾ inches; the thickness of plating is given at ⅜ inch, it should be ½ inch. In describing the connection between the stern tube and the skin of the vessel, the author says that it "tapers at a much more rapid rate than the tube which it supports. This is done probably to afford the water as free a run to the screw as possible, but this intention is in no small degree defeated by the fact that the bracket arms which support the stern bearing are attached to the hull at points considerably above and below the after thin end of the cellular structure referred to and have to be dragged through the water, and must by whatever resistance they oppose, impair the speed of the ship."

Now this fact here stated as defeating the design, is not a fact at all, as the cellular structure he refers to terminates on the arm of the strut, which is rabbeted to receive the plating, one of the objects of the structure running out to the thickness of the strut arm being to avoid the resistance due to dragging the strut arm through the water.

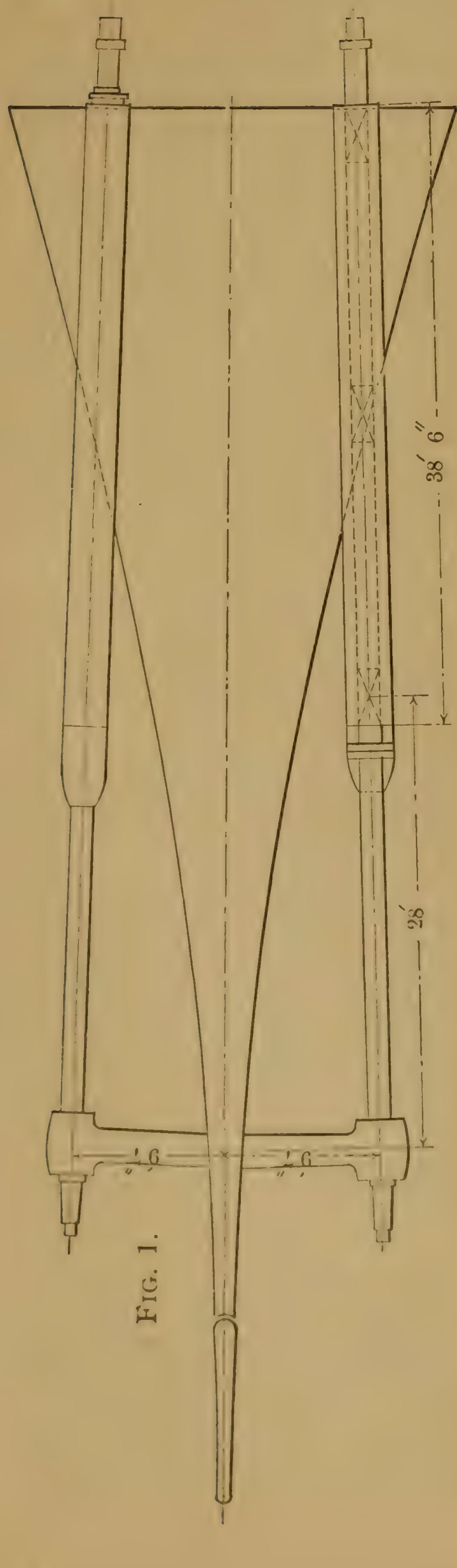


Fig. 1.

Fig. 2.

The thickness of the bronze casing on the stern shaft is given at 1 inch, it should be ¾ inch; the weight is given at 6,000 pounds, it should be 4,110 pounds; the water surrounding the shaft in the tube is given at 10,000 pounds, it should be 9,500 pounds; the weight of bronze on the shaft and water is given at 16,000 pounds, it should be 13,610 pounds; which would be 27,220 pounds for both sides, instead of 32,000 pounds, as given by the author.

I do not find fault with the figures given relating to these tubes and the bronze casing on the stern shafts, only that they should have been compared with similar parts on other cruisers or vessels. Any one not an expert, would conclude that the bronze covering on the *Olympia's* propeller shafts here described and the weight given, was a necessity of this faulty construction, and was not required on the stern shafts of other vessels, and that stern tubes were not necessary on the modern twin screw vessel.

In order to place this matter clearly before the readers of "INDUSTRY," it will be necessary, before taking up the "reflections" that were suggested to this writer by an examination of the *Olympia's* drawings, to give a little of the history of the particular form of stern tube fitted to the *Olympia.*

The accompanying drawings, Fig. 1 shows the stern tubes of this vessel as originally designed at the Department, and Fig. 2 the stern tubes proposed by the builders and approved by the Department.

The original design is similar to the arrangement as fitted to the U. S. S. *San Francisco.* In the original design for that vessel, the stern tubes ended at the skin of the vessel, leaving the shaft unsupported for a distance of about 41 feet, with a coupling near the stern tube. I made a strong effort to have some such plan as that in Fig. 2, fitted to the *San Francisco*, and a compromise was agreed upon by extending the tube further out to get a support nearer to the bracket bearing.

The Department had in this the precedent of practice by eminent builders in support of their plans, and a plan of the stern tubes and supports of the S. S. *City of Paris* was sent to show that our objections were not supported by the best practice.

In a letter to the Bureau of Steam Engineering, dated May 24th, 1888, a similar arrangement to that on the *Olympia* was proposed. I will quote a few sentences from this letter, to show the position we then held here on this question:

"According to the present plans and specifications for propeller shafts, stern tubes and supports for same, the distance between bearings, in our opinion is excessive. If we take the points of support as, say, once the diameter of the shaft, aft of the forward end of stern bracket bearing, and once the diameter of the shaft forward of the after end of the stern tube bearing, the distance between these points is 40 feet, with a coupling near one end of the span. * * * * * * * * * *

The coupling being outside the vessel, and beyond the reach of inspection, makes this a very dangerous point on the shaft, as a failure of this coupling would be a very serious matter." (The *City of Paris* disaster had not then happened.) * * *

"We are confident that the Bureau of Steam Engineering will agree with us in this, that the shorter that portion of the shaft that cannot be examined, the better it will be, both for the machinery and the ship."

After describing the proposed method of supporting the shafts, and moving the stuffing box about 30 feet further aft, the letter goes on to say that:

"The plating used would be the same as for the outside of the vessel, and the work done in the same manner. There would be an increase of about ten tons in weight by the adoption of this plan, but there would be also an increase of about twenty-two tons in displacement.

We desire to urge upon your Department a careful consideration of this proposition, as we do not feel satisfied that the stern shafts as now supported will be perfectly safe in working, and the disastrous effect that might be the result of a failure has led us to give this matter a very careful study." * * * * * *

The Department did not care to make the radical change we suggested, but a compromise was agreed upon, whereby the stern tubes were lengthened so as to shorten the unsupported part of the shaft outside of the vessel. This modified plan was adopted in the Department plans for cruiser No. 6 (*Olympia*). It will be seen by this plan (which is very much the same as those of the cruisers built by the Cramp Company) that seventy feet of the shaft is outside the stuffing box, with a coupling in the middle of this length; while the plan we proposed and which was finally adopted, moved the stuffing box thirty-seven feet further aft, leaving only the after length of the shaft outside. In the original plan "fifty-seven feet of the shaft was to be cased in bronze, while the modified plan reduced this to "thirty-one feet." In fact the only difference between the stern work on the *Olympia* and that now fitted to the most modern type of twin screw passenger steamers, consists in fitting a well or opening through the stern in line of the propeller

blades, which permits of the shafts being brought closer together, permitting of the stern bearings being carried by a horizontal arm instead of the double-armed strut. The projection of the hull work is then built on a horizontal plane instead of being normal to the skin, as in the *Olympia*, although some prominent naval architects still claim that such projections should be normal to the skin at all points.

Now, in regard to the reflections indulged in by the author of the article in the *Scientific American.*

His first criticism is that "These brackets, it is true, are quite similar to those in common use for many years for the support of the stern bearings of twin screw shafts, and if there were no better method of accomplishing such support, criticism would have no claim against them, but as it is well known, there is a better way of attaining the end sought, and therefore, in a cruiser where speed at a critical time may involve her own safety and that of her personnel, such improved methods should have been adopted."

If the author of this strange article finds that the stern work of the *Olympia* is similar to those in common use, why has he selected that cruiser instead of some of those built at the Cramp's yard? He knows very well that the *Olympia* approaches nearer to the most modern method of supporting twin screw shafts, than that of any other cruiser afloat.

The only difference between the stern work of the *St. Louis* or any of the most recent Atlantic liners, built since the disaster to the *City of Paris*, and the *Olympia*, is simply in there being no opening through the deadwood of the cruiser, the shafts being further apart, and the structure carrying the shafts being built on normal lines, instead of being built horizontal, and I am convinced that with the greater projection necessary where there is no well, being built on normal lines, offers less resistance than it would do if built horizontal. The only saving effected by ending the tube structure on a horizontal beam, is that it costs less, but could hardly have been carried out in the *Olympia's* case with nine feet six inches of projection. There must be in every case a certain length of shaft tube between the stern bearing and the stuffing box. That of the *Olympia* is very little more than usual in single screw vessels, is less by far than any other twin-screw vessel in the Navy, and probably little more than that of the *St. Louis.*

The author of this article refers to the extra buoyancy obtained by the displacement of the shaft tubes by the new construction. I cannot see why there should be any difference in buoyancy or dis-

placement, whether the projection carrying the shafts is horizontal or normal. The extra buoyancy obtained on the *Olympia* by carrying the shaft tubes out to the strut and making them large enough to have the stuffing box outside the ship, was 57,216 pounds.

Why did not this writer compare the stern work of the *St. Louis* with the cruisers built at the same yard? It would have been a better showing for what he is pleased to term a better way of attaining the end sought. Why did not the experts of the Cramp Company propose this better construction to the Navy Department? The Bureau chiefs are not so set in their own designs but that they are willing to adopt anything better that may be presented. It is a pity that the Cramp Company did not know of this better construction in time to save the Department from taking a step (if not a tumble) backward in the case of the *Olympia*.

Judging from the direction taken by recent discussions on the form and position of projected structures on the outside of vessels under water, and from recent tank experiments, the normal position as opposed to the horizontal for structures carrying propeller shafts, is that of least resistance, and, after all, the Cramp Company may have to take another step forward to get alongside of the *Olympia*.

G. W. DICKIE.

OLD MASTER MECHANICS.*

No. II.

The development of woodworking machines was intermittent or spasmodic, as described in the last number of INDUSTRY. This has not been true of iron-working machines. The course of improvement has been very regular since 1835, or thereabout, when Bodmer directed his attention to machine tools.

JOHN G. BODMER.

Among those who have given their attention to tools none can claim more, perhaps no one so much, as John G. Bodmer, a Swiss engineer, who, about forty-five years ago, established a works at Manchester, England, and prepared an equipment of tools that furnish precedents for nearly all that modern practice comprehends.

In 1869, after Bodmer's death, the Institution of Civil Engineers, London, published a memoir relating to his engineering works, a

* Extract from a lecture prepared by the Editor in 1882.

very unusual proceeding for that important Institution. In this memoir was published the subject matter of two of his most important patents, those of 1839 and 1841, also a list of eleven other patents pertaining to various branches of constructive engineering work.

Bodmer's shops were supplied with standard gauges, and the duplicating system was carried out completely as in the shops of our time. I do not know the fact, but strongly suspect that the manufacture of such gauges by Sir Joseph Whitworth had its inception in Bodmer's shop.

It seems incredible that so many of our modern appliances should have been produced by this wonderful man. I can mention only a few of them, and these not at length. His patents may be examined at the library of the Mechanics' Institute in this City, and it will repay anyone for the trouble.

A circular planing machine, described in the patent of 1841, is the American "boring mill." I do not see why it is called a "mill," for certainly the name does not apply, and Bodmer's name of "circular planing machine" is more relevant to its purposes. Name aside, it is the same machine that now has a prominent place among machine tools. Its earliest manufacture in this country began at Cincinnati, Ohio, and contrary to the case of most machines, it made its way east as far as Philadelphia, and then into New England, where many are now made. Bodmer's machines were complete, containing all the movements and adjustments required, including a rim bearing under the face plate or table, and a wedge to lift the plate clear of this bearing, so as to permit high speed.

His wheel-cutting machines were the most elaborate ever made down to a period of not more than ten years ago, and except two or three machines only, still remain the most complete. I am not prepared to say that Bodmer's is the most elaborate of all, because it is some years since I have examined the drawings.

The reamers used by Bodmer had a single blade, and I was much astonished a few years ago on visiting the works of J. Morton Poole & Co., of Wilmington, Delaware, to find there the Bodmer reamers in use for finishing holes that our common tools would not make. Messrs. Poole construct chilled rollers, and for the shorter ones insert wrought iron shafts. These shafts are from three to four inches in diameter, too stiff to bend, and are forced in by powerful hydraulic presses. The bearing is throughout, and the holes are made perfect, polished from end to end, and so true that a diameter

gauge, or a straight edge, will not show the least defect. Such holes to thirty inches long are made with Bodmer's reamers. The convolute taps now made as an article of commerce, and called "relieved taps," were made by Bodmer, and cut in the same manner now practiced at Philadelphia by the tool makers there. The tool being given a slight movement to and from the work, such motions conforming to the number of grooves.

Bodmer's planing machine, driven by means of a screw beneath the platen meshing into a rack, was, in so far as functions and movement, much like that of Sellers & Co.; the latter firm have, however, improved the mechanism and cheapened it.

One thing more, however, we must give some time to. Bodmer introduced into his works what is called diametrical pitch for tooth wheels. His patterns were made without reference to the particular distance between the centers of the teeth, the number of the teeth being based upon the diameter instead of the circumference of the wheels. I wish to invite your especial attention to this matter, because I do not know of any other thing in mechanics that better serves to show how hard it is to introduce improvements.

You all know that the diameter of a gear wheel is its chief dimension, so to speak. This is the first line laid down in drawing a wheel. It is the main matter dealt with. We always speak of a wheel by its diameter, as a four-foot wheel, a ten-foot wheel, and so on, but when we come to arrange the teeth we abandon the diameter and deal with the circumference, which commonly contains an inconvenient fraction.

If we resolve the circumference into a number of whole inches then the diameter must contain the inconvenient fraction. Any of the common gear-wheel lists will show this; the diameter, which should be in whole numbers, contains in most cases confusing fractions.

Now what possible difference can it make what the distance may be between the centers of teeth so long as this pitch is adapted to the purpose and uniform in wheels that run together. In the tool works here we pay no attention to the pitch between teeth. Our wheels are made three, four, five, six or eight teeth to each inch of diameter, and what the distances are between the teeth, or the circumferential pitch, as it may be called, gives us no concern.

In the works of Brown & Sharp, at Providence, and at the various tool works in Philadelphia, diametrical pitch is used. Brown & Sharp, who are certainly a good authority, were the first in this

country to adopt such a system, and to them belong such credit as may be allowed for the invention or resurrection of Bodmer's system.

I believe among the makers of small wheels in New England the force of circumstances have compelled the adoption of diametrical pitch. Three teeth to each inch of diameter brings a circumferential pitch of $1\frac{1}{16}$ inches; four per inch is ¾ inch pitch; five per inch is ⅝ inch pitch; six per inch is ½ inch pitch; eight per inch is ⅜ inch pitch, and so on. This is not precise, but is so nearly so that, as I said before, the makers of small wheels have perforce adopted diametrical pitch to avoid absurd fractions in the diameter of blanks.

In connection with this matter I will now explain a rule of Messrs. Brown & Sharp respecting whole diameters that is very convenient. Everyone who has to deal with wheels knows how difficult it is to ascertain extreme diameters. The pitch diameter is the one dealt with in making drawings or computations, but the whole diameter is the one a workman has to deal with in turning up gear wheels that are engine cut, or pattern for castings. One cannot caliper a pitch diameter; it is an imaginary line.

By writing the figure 2 over the top of the diametrical pitch the fractions produced are the parts of an inch to be added to the diameter of a wheel beyond the pitch line. For example, if the pitch is four per inch the rule gives two fourths or half an inch. If the pitch is six per inch, the fraction is two thirds, and so on. I have spent a good deal of time on this invention of Bodmer's, but the subject warrants it. He employed in his shop special wooden rules marked for the diameters of wheels of different pitch, and carried out the system completely.

HENRY MAUDSLEY.

In the Parish of Lambeth, London, is the old works of Maudsley Sons & Field, of whom everyone has heard. Henry Maudsley, the founder of the business, was one of the old masters in every sense of the term. He made the block machinery of which some account was given in the May number of INDUSTRY. For a time at least, he was certainly the leading mechanic of his time. In these old works is a lathe made about the year 1816. In Smiles' Industrial Biography, published in 1876, there will be found the following description of this lathe:

"He continued to devote himself to the last to the improvement of the lathe, in his opinion the master machine, the life and soul of engine turning, of which the planing, screw-cutting and other

machines in common use are but modifications. In one of the early lathes which he contrived and made, the mandrel was nine inches in diameter; it was driven by wheel gearing like crane motion, and adapted to different speeds. Some of his friends on first looking at it said he was going 'too fast,' but he lived to see work projected on so large a scale as to prove that his conceptions were just, and that he had merely anticipated by a few years the mechanical progress of his time. His large removable bar lathe was a highly-important tool of the same kind. It was used to turn surfaces many feet in diameter While it could be used for boring wheels, or the side rods of marine engines, it could turn a roller cylinder twice or three times the diameter of its own centers from the ground level, and indeed could drive round work of any diameter that would clear the roof of the shop. This was therefore an almost universal tool, capable of very extensive uses. Indeed much of the work now executed by means of special tools, such as the planing or slotting machine, was then done in the lathe, which was used as a cutter-shaping machine, fitted with various appliances according to the work."

Maudsley was among the first, if not the very first, to make war upon the angular and sharp-cornered form of framing for machinery. Of this Mr. Smiles says:

"Thus one of the points on which he insisted—apparently a trivial matter, but in realty of considerable importance in mechanical construction — was the avoidance of sharp interior angles in iron work, whether wrought or cast, for he found that in such interior angles cracks were apt to originate, and when the article was a tool the sharp angle was less pleasant to the hand as well as to the eye. In the application of his favorite round or hollow-corner system — as, for instance, in the case of the points of junction of the arms of a wheel with its center and rim — he used to illustrate its superiority by holding up his hand and pointing out the nice rounded hollow at the junction of the fingers, or by referring to the junction of the branches to the stem of a tree; hence he made a point of having all the angles of his machine framework nicely rounded off on their exterior, and carefully hollowed in their interior angles."

JOSEPH WHITWORTH.

Sir Joseph Whitworth, who may also be classed as an old master, although living at the present time, once in his public lectures employed a similar illustration to that of Mr. Maudsley. "See," said he, referring to the bones of animals, "how Nature constructs her framing with hollow sections, and without angular corners."

Of Whitworth's contributions to exact fitting, also to various improvements in methods and design it will be fair to say that he modified the practice of the world. His surface plates, exhibited

first at Glasgow, as now remembered, in 1848, was the first instance where metallic surfaces were made so flat as to exclude the atmosphere. They were regarded as a miracle, but from that time, and even now the flat surfaces in his works are prepared by surface plates, and approximate if they do not equal the plates in general truth.

Some years ago when in Sweden I was declaiming against flat-top lathe frames, and urging the superiority of the angular or **V** ways commonly employed in this country. The Swedish manager of the Government Railway Works, whom I was conversing with, said: "You fit your lathes that way for cheapness and to avoid fitting. The flat surfaces are better if properly fitted."

I answered that true or at least easy movement could not be obtained on these large surfaces, and if he had a Whitworth lathe in his works I would show him that the carriage would "shake," also would be hard to move. We went into the works, and he selected a Whitworth lathe, one to turn twenty inches in diameter, and asked me to prove my assertion. I could not with a bar inserted in the slotways move the carriage at all; it seemed as solid as the frame on which it was mounted, and I fell back on the friction. The manager moved back the sliding head, detached the feeding gear, and with one hand slid the lathe carriage back and forth on the ways. This was a new lesson never forgotten, especially as the manager then went on to explain how it made no matter how the strains fell on the carriage, and that it moved absolutely true for all kinds of work.

Whitworth, when a young man, worked on the Babbage computing machine, and his fame rests in a great degree upon the high standard fitting which he introduced in machine-tool practice, also on other kinds of work. His methods, and to some extent his designs, were introduced into this country by Messrs. William Sellers & Co., of Philadelphia, and I can well mind when this firm were struggling to make people understand what they were doing. Their curious castings, without ornament and without corners, and scraped surfaces were regarded as no part of common-sense work. We all know better now.

In all countries can be found these old masters. Those of England, where a century ago machine practice was much in advance of the rest of the world, were most numerous. Language and relations with that country have brought these men to our notice especially. During the past fifty years there has been a diffusion of skill, and

there is no longer possibility, as in earlier times, of one man modifying the methods of industry.

These remarks, confined almost wholly to practical shop matters, it is hoped will be considered a kind of respite from studies of a higher kind. They have no object more ambitious, but it must be remembered that even workshop processes must occupy a prominent place in the economy of production, and that they have engaged the best efforts of men of high rank in mathematics and applied sciences.

One of the main purposes of this paper, written thirteen years ago, has been rendered useless by circumstances since that time. I mean the interchange of ideas all over the world by means of serial and other literature, and the breaking down of the exclusive system within that time. It is but a short time, yet the change is marvellous. A discovery or invention of any kind in Calcutta or St. Petersburg is known here on the Pacific Coast by the first mail, or even by telegraph if important. No nation can arrogate to themselves a transcendent place in arts that have become universal.

While this great change has been going on in science and mechanic art the commercial world is moving the other way, and is a system of reprisals, sectionalism and strife. Mercantile business of our day is where learning and industrial science stood forty years ago, when it was believed that what one nation gained another must lose.

The medical profession, which may be claimed by science, was the first to cast off the shackles of prejudice, and nationalize their art. The engineering profession is fast doing so, and finally let us hope human interests of all kinds will flow over national lines, and wars be classed with barbarism.

EVOLUTION IN WORKSHOP PROCESSES.

It requires a certain period for new things to spread, no matter what their merit may be — a course of "evolution" we may say. In looking back over quarter of a century, every one old enough can remember and point out some "rejected stones," that in the end are hunted up and take their natural place in the arch of progress.

In 1865, thirty years ago, we had trouble in finding space for the countershaft that drove the last or under cylinder of wood-planing machines, and by a happy thought set the shaft in front of the main

one, and led the belts of the main cylinder over those for the rear one. This was roundly condemned as inefficient and awkward, but it worked all right, and is now common practice, but it has taken a long time to become so.

In 1862, when the machinery for a cabinet factory in Columbus, Ohio, was being constructed, among other things made were sand-paper buffing wheels. The owners, who had observed the matter, claimed that the sand inhaled by the workmen was dangerous to the lungs, and directed that some means be provided to carry off the dust from these wheels.

A wooden fan was made and placed under the floor, the machine covered in and connected with the fan inlets. This answered perfectly, until one day by accident some shavings got in, and the workmen were amazed to see these shavings blown out fifty feet away. They began putting shavings into the machine, and kept it up as long as any could be found. A "sweepway" was made to the fan inlet, and the discharge pipe connected to the firing room.

This we believe to be the beginning and perhaps the first shavings conductor of the kind; at least is older than various patents afterwards taken out for such apparatus.

Not always, however, are useful things perpetuated. Some of them fall by the way in a most unaccountable manner. More than forty years ago a Mr. Holmes, in Ohio, discovered by experiment that common wooden-vise screws with angular threads consumed more than one half the power applied to them in friction, and that a square-thread screw with a pitch of 1¼ inches required less force in use than the angular threads with a pitch of ⅝ inch.

In a vise fitted with one of these square-thread screws, not only could the work be fastened with half as much movement and in half the time, but could be "let go" by a mere touch, the angle of the thread being near the coefficient of friction. He made a very ingenious machine to cut square threads for both screws and nuts, and supplied his friends with screws. The Ohio Tool Company, at Columbus, Ohio, provided new and improved machinery, and began the manufacture of these screws, but sold them at a higher price than the old kind. Some progress was made, but not much, although one of the new screws would save its value every month in time and convenience.

The most remarkable invention of the kind, however, that we can refer to, is that of machines made in Canton, Ohio, for cutting perfectly, by very simple means, the teeth in bevel wheels. The

operation was performed on shaping machines rigged up with a kind of oscillating tool that we will not attempt to describe, but will only say that the teeth were of correct form, and made so cheaply, by boys, that reaping and mowing machines made by the firm of Ball & Co. were for many years fitted up with these cut bevel wheels. The art ended in that works, so far as we know.

Not only would these simple machines cut bevel wheels "accurately," but the same machines made their own cutters by using a serrated "matrix" to shape the tools. This circumstance we have always set down as the most remarkable one in shop manipulation ever met with in a tolerably wide experience.

CRANKS.

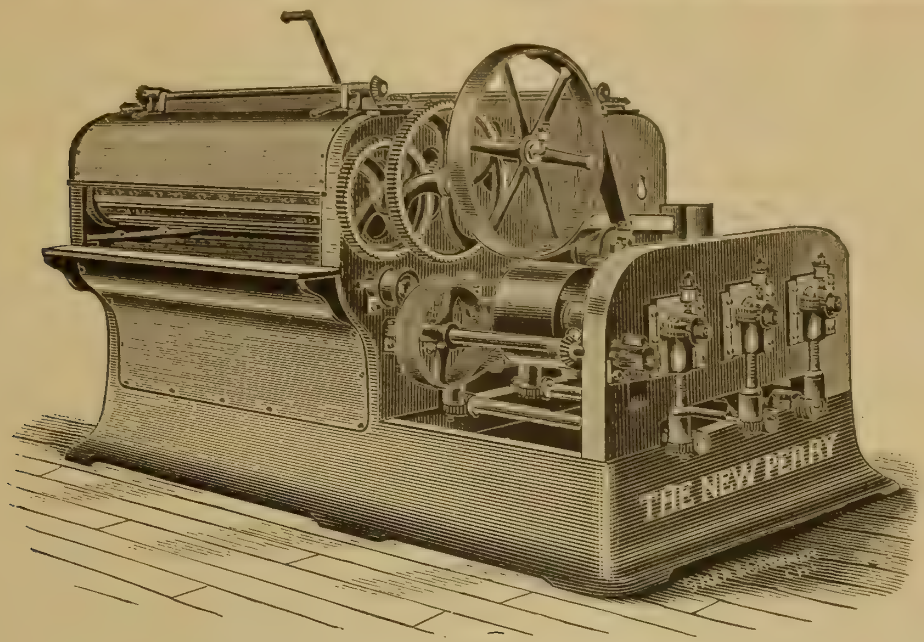
This term crank by strange coincidence sometimes is found in both its human and mechanical significance combined. Then when crank meets crank comes the tug of — nonsense.

A contemporary extracts from the *Salt Lake Tribune* an account of some one who has dispensed with the crank of a steam engine, and has converted the full force of the piston into turning moments of uniform intensity "all around," and thus has done what a good many other people without even rudimentary knowledge of mechanics have done before him.

The crank is the soul of reciprocating steam engines, that is, the element which renders a reciprocating engine possible, because it is the means of accelleration for the reciprocating parts, without which no engine could be operated at a "commercial" speed. As to losses by a crank, this is another fool's proposition that may be classed with "leverage," and relegated to those who are ignorant of the elementary laws of dynamic effect or work as a resultant of force and movement.

The Salt Lake man by some kind of a rack, or other device, may attain a constant turning strain, and thus diminish the area of his steam cylinder one half, and by adding fifty per cent. to its length, or perform double work with a cylinder of given diameter, but the consumption of steam will be just the same as when a crank is used, but the reciprocating elements will come to grief in a short time, unless it is a steam hammer he is experimenting on.

We owe an apology for noticing this problem of "cranks." No reader of "INDUSTRY," we trust, is in need of suggestions on such a subject.



THE PERRY SAND-PAPERING MACHINE.

THE PERRY SANDER COMPANY, THE ROOKERY, CHICAGO.

It will seem a strange proposition to say that a class of machines now standard or universally employed in the manufacture of joiner work at the East, are unknown on this Coast, unless it be in some of the principal door and sash factories, and we have been informed they are not in use even there.

Before speaking of the effect or purpose of the machines, of which one of the latest is shown in the drawing, we will point out the inevitable path of "evolution" they have come through.

The application of sand paper by machines is an American invention that depended at first to a great extent upon the production of suitable web paper for this purpose, a problem worked out mainly by Messrs. Baeder & Adamson, of Philadelphia, Pa. The covering or abrasive surface is, or was some years ago, a fine flint stone procured in Nova Scotia, which was found superior to glass, commonly used for like purposes in Europe. The web itself required strength almost equal to cloth, and the adhesive glue had to stand a good deal of heat as well as moisture, unavoidable at times in the Eastern climate, but the problem was finally worked out, and paper of all grades of fineness was made to stand use on drums when the drums were properly made.

The machines have been in "evolution" about twenty years, all the time rising in quality, efficiency and price, until at the present time there seems to be nothing more to do in improving them.

The stuff, that is all flat surfaces to be painted or varnished, is

put through the machine at a cost that aside from the wear of the paper is hardly considerable, and the result a perfect surface irrespective of grain or texture of the wood. The greatest effect economically is in "cleaning off" sash doors and other framed work where the grain is crossed, or at right angles.

The company at Chicago send the following description of the Perry machine shown in the drawing:

"The new "Perry" is a triple-drum endless-feed belt sander. The three drums are made of steel and iron, and can be contracted and expanded when the sand paper is renewed. The circumference of the cylinder is covered with the very best of packing, which is varied according to the work to be done. As usual in triple-drum sanders the paper may be graded, the first cylinder having coarse paper and the other finer. The distinctive feature of our drums is that they can be contracted and expanded. Besides this the drums have at one end a removable bearing. The purpose of the removable bearing is, first, to make the change of paper easy and quick; and, second, to remove the cylinder itself if necessary.

The paper is formed into a hollow cylinder, and tightly clamped by our patent fastener, then with the end bearing removed, and the drum contracted, this hollow cylinder of paper is slipped on over the drum into place, the drum is expanded and the bearing replaced. In this operation there is no loss of adjustment either of the cylinder or feed, and much less time is taken to change the paper than with any other previous construction. The drums can be adjusted independently of each other according to the cut desired. Above the drums in place of the ordinary rigid metallic feed rolls used on all other sanders is the rubber-faced endless belt.

The endless feed belt consists of twenty-nine parallel slats linked together at the ends, and passing over sprocket wheels at the ends of sander. These metal slats have mortised into them, and held in place by a steel band, heavy rubber strips. The metal slats in the feed belt are held rigidly against the stock by two or three pressure bars, so that any stock which might be warped is held evenly and tightly down against the cylinders and lower bed.

The rubber faces have, first, a firm hold on the stock, and there is no danger of stalling; second, they have a continuous hold, so that the stock is never once released from the time it enters the machine until it leaves the last polishing cylinder; third, it will carry through short stock not more than four inches in length, one piece at a time, or as many together as the width of the machine will allow; fourth, it will pass through stock varying slightly in thickness, as, for example, hard-wood flooring, and, fifth, if any dust sticks to the rubber it will not print the stock, a very common and unavoidable fault with feed-roll machines. Another feature of the construction is that all of the pulleys and the few gear wheels are enclosed within the machine, and the shafts of the cylinders have three bearings. The illustration shows practically all the gearing there is

on the machine. The feed belt does away entirely with the thirty or more gear wheels used in other machines to propel feed rolls.

The feed and oscillation are driven by a short belt taking its power from the cylinder shaft, and the entire machine is thus driven from a single pulley on a short countershaft. As the endless feed belt is driven from the cylinder shaft there is no danger of the feed belt stopping unless the cylinders stop also, consequently the stock cannot stop over the cylinders when the latter are in motion; however, by a very simple device the feed can be stopped instantly without stopping the cylinders."

THE CYANIDE PATENT.

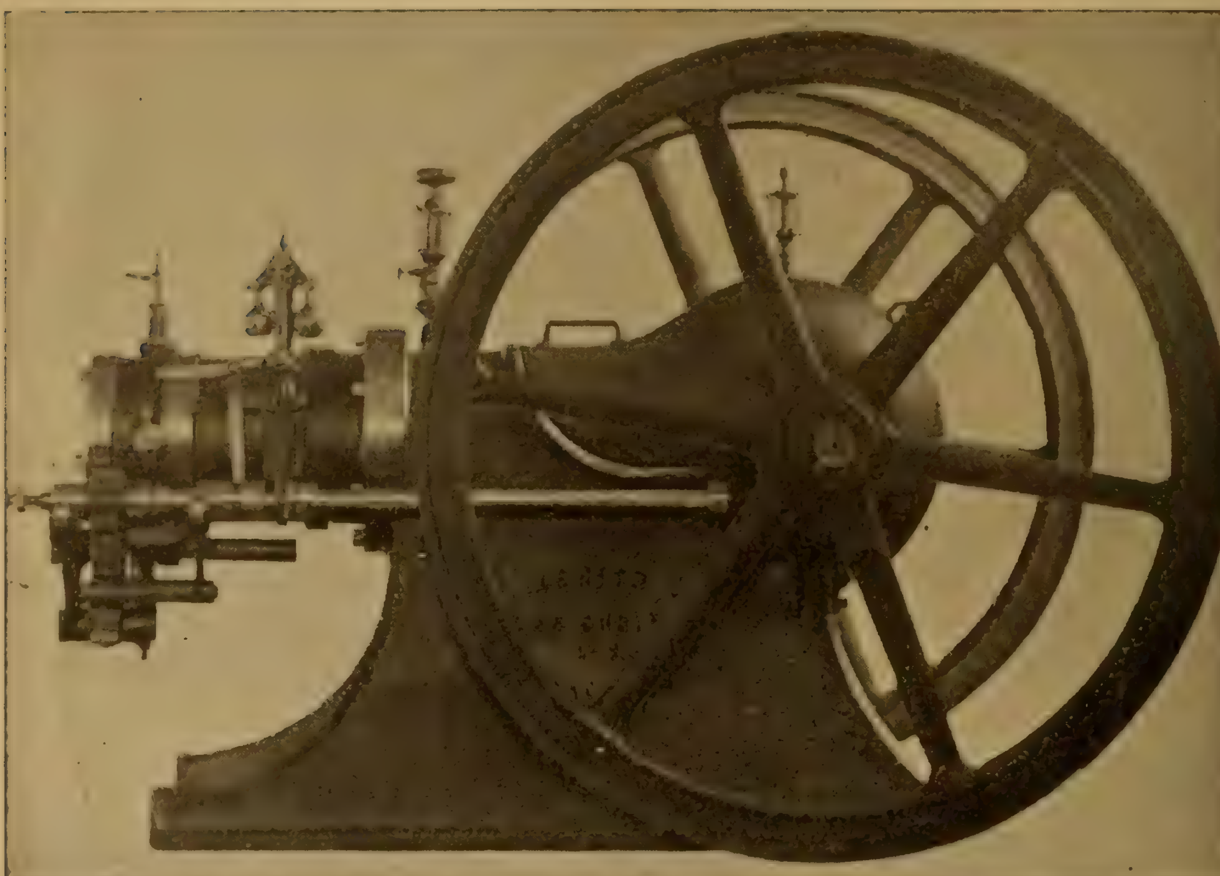
The recent and second, but different, decision in England against the MacArthur-Forrest Cyanide patent for gold extraction contains a wholesome lesson for those who frame specifications for the British office. In both the lower court and on appeal there was conceded the novelty and utility of the invention, in so far as the use of a weak solution of potassium cyanide.

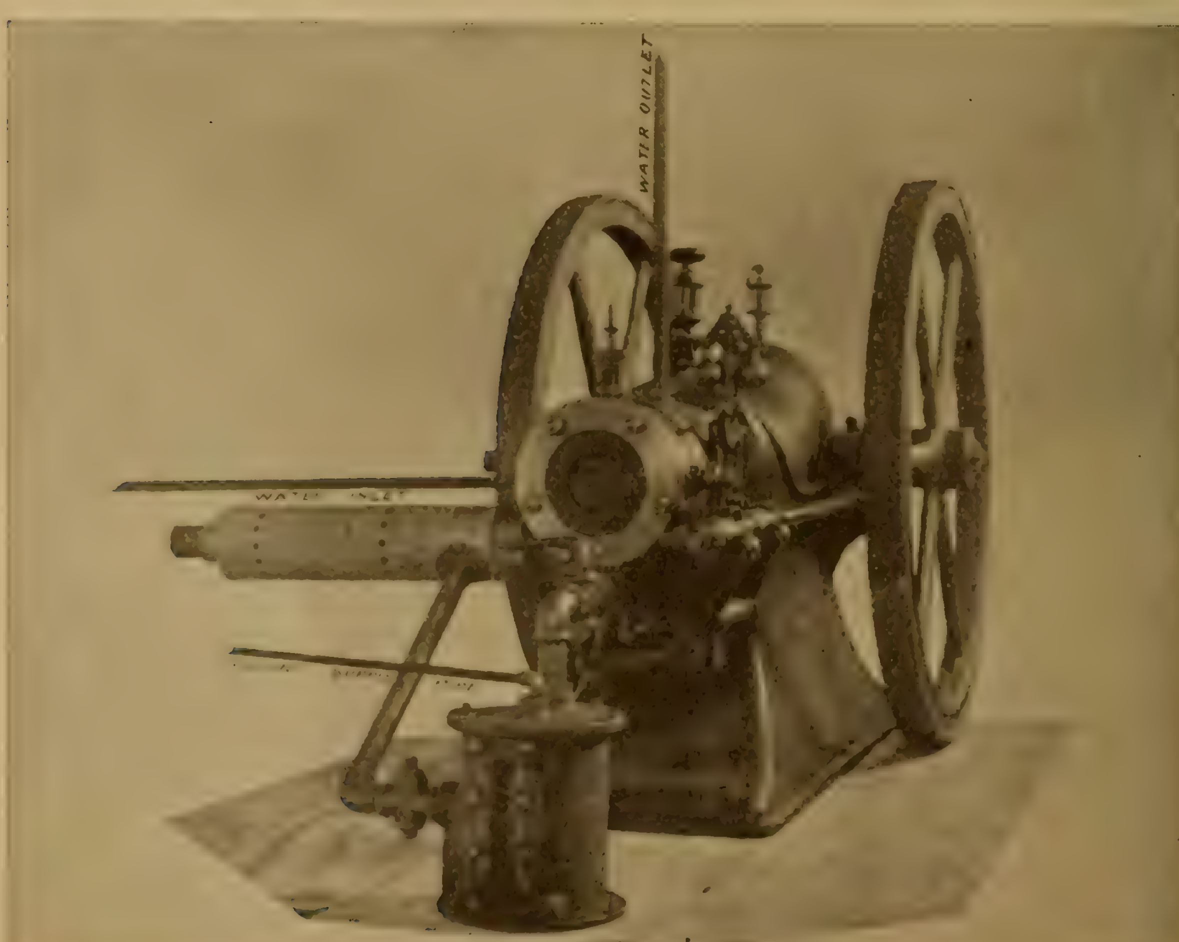
The American patent of Simpson, of 1885, which was an earlier one, called for a mixture of cyanide and carbonate of ammonia, which is different in great degree from the MacArthur-Forrest method. The fault in the later patent was in claiming broadly the use of cyanide and of cyanide compounds, generally for the extraction of gold. This might have been done guardedly in a provisional specification, but in so important a case as this any competent patent agent would have informed himself of the state of the art, especially in England, where the onus of overclaiming must rest with the applicant and his agent.

The decision against the patent was a "legal" one, reluctantly given, but nevertheless fatal to the present form of the patents. The criticisms of the *Engineering and Mining Journal* two years ago, were made on the basis of the sweeping claim, and were warranted, as the present decision shows. We are writing in advance of any comments in that journal, but expect this to be their explanation.

The next movement will, no doubt, be to disclaim the broad character of the original specification, and the patent thus amended, if that be possible, will not be questioned again during its term. Such powers of amendment are but fair, and should be a part of any patent law intended to protect meritorious inventions in the case of inadvertent overclaiming. Such a law exists in France.

An inventor should claim only what he has discovered, and no more. Indeed anything more is fatal if a patent has to be defended in the courts, as nearly all important ones have to be.





THE ZENITH GAS ENGINES.

THE ZENITH GAS ENGINES.

THE ZENITH GAS ENGINE AND POWER CO., HARBOR VIEW, SAN FRANCISCO.

San Francisco has already become famous for the construction of gas engines, or as we may say, the use of these engines has spread more rapidly on this Coast than in any other part of the United States, or comparing on the basis of population, more extensively than in any other part of the world, not excepting even Germany, where such engines originated and have been very widely applied.

The latest design that has come to notice, is that of the company above named, and is shown by the views on the opposite page, the side view indicating the proportions and arrangement, and the end view an engine provided with a "carburettor" for gasoline, that has now been abandoned for a new patent injector, by means of which the oil or fuel is supplied as a liquid, and vaporized in the combustion chamber of the engine. The design shows careful working out for an engine of this type.

We notice among the novel points, complete enclosure of the crank and connection, so as to attain "saturated" lubrication of the piston and all running joints, also an adjustable "timing" device, by means of which the position of ignition or firing the charge is at complete control while the engine is in motion.

This is a subject respecting which there exists quite a difference of opinion, indicating a variation of the conditions under which an engine is working, and the advantage of an adjustable "timing" device is that it admits at any time of demonstrating the most advantageous point of ignition, which we imagine varies with the nature of the fuel, or the rapidity with which it burns, explosion being slower with attenuated or diluted gas, than when it is richer or more heavily charged with carbon.

The consumption of fuel is given at one pint per horse power per hour of 74° gasoline, which is far below the possibilities of steam power, in this part of the world at least. We are informed that in a test of one of these engines made recently at Prof. Price's laboratory, in this City, the consumption of gas was only 18 cubic feet per horse power per hour. The test was made by Engineers Rolfson and Behr, of this City, with an engine of 5½ horse power, operated at 6 horse power under the brake.

There are design and other patents on the engines, and the manufacture is an important addition to the industry here.

EXTRACTS FROM A NOTE-BOOK.

BY "TECHNO."

No. XXX

TALKING SVENSK.——MOVING A COUNTRY.——CANADIAN PACIFIC.

VANCOUVER.——HOW CLIMATES ARE MADE.

—Lying at the back of my draughting board one morning I found a letter bearing the well-known chirography of my Uncle Camshaft, a foreign stamp, evidences of wear, and bulky for a letter of his. It was from Southampton, England, and ran thus, omitting the head:

"We go out to the west coast of America from here; to Vancouver. The ship is there to be turned over to new owners, and I am going ashore, north if alone, south if you will bring that everlasting note-book and join me. We go through the Straits, and fifty days from now should be in Burrards Inlet, they call it (outlet it should be) for the Fraser River, but geography aside the point is high enough to start from. Write me at Vancouver."

The bulk was made up of a map. I counted off the degrees of longitude, and was appalled at the distances, but here of all other trips was the one desired, and decision did not lag. The note-book was looked up, other preparations made, four long weeks, and off. Here is the first note:

—I wanted a look at St. Paul and St. Anthony again, and went there, then turned off at a right angle north to Winnipeg, and on the way there saw the wheat country and Scandinavians.

They elect Norse congressmen somewhere up in this region, and should, I think, have several if fairly represented. Half or more of the population bore the impress of "Scandia" in appearance and tongue, the strange idiom which no one except Bill Nye ever learned to imitate. Here for a divergence, let it be written that the nearer the analogy between two tongues the more difficult it is to learn both. A Russian may ask you to put from two to four v's in front of a word, v-v-v-vitch for example, and after a struggle or two it is done completely, just as the Russian did it.

A German may ask you to spell horse with a *p* and an *f* together, *pferde*. You do it with a trial or two, and can ever after in good German, but let a Chinaman give you a pair of his monosyllabic words that sound like *chi ching*, and a hundred trials floors you. The gentle Swede tells you his language is *lätt at lära*, "light to

learn,'' which is nearly English, and you can set that down to begin with. It seems simple, but it is not, the cadence, inflection, modulation, or whatever it may be called, is impossible. A thousand elusive attempts will do no good, a breath betrays you. It is just like music, in fact a musician learns such sounds much easier than the man fitted for ''treason, stratagem and spoils.'' I do not mean the language is musical, although that might be said of the Swedish branch. It is a curious indescribable sound, ten times as difficult to learn as a pile of consonants in Polish.

These Scandinavians go up there into Dakota to raise wheat. They also raise the soil, and ship it off by rail. While this thin or thick layer of loam was made, though some centuries as a buffalo pasture, these animals removed nothing. Their manure, carcases, horns and hoofs remained on or in the ground. So with all vegetable growth, but now wheat is grown. The grain is sent away, the straw is burned, or sent away also. All animal growth is sent away, and the essential elements of the soil goes along. In twenty years more the whole top will be gone, the people too, unless they all die. It will be like the tobacco districts in Eastern Virginia — require a century of rest. The country ''seems'' all right just now, but it is not, or at least will not be long.

Winnipeg, Red River of the North, low temperature, first post of the Hudson Bay Company, Canadian Pacific, are found after a long ride over a ramshackle railway, with an interlude of a customs inspection of baggage, an intolerable nuisance. This straggling town of Winnipeg betokens in various ways its perennial or half yearly business. It is of the hybernating class. In the winter the streets are paved with ice, and the country clothed in snow, the thermometer hovering about zero, sometimes there, but oftener below, away down to thirty or even forty minus.

The Canadian Pacific Railway is mainly on the American system, with some features of the British, and so far as I can see is by far the best of the trans-continental routes. It is a complete line for one thing, under one management from the Gulf of St. Lawrence to Puget Sound. There are not many differences from the American lines of the best class, in so far as machinery, carriages, and so on, if we compare with the best lines, but there is a good deal of difference in what the naval folks call the ''personnel.''

I had just got settled into a comfortable seat in a glass-lined smoking room at Winnipeg, when an official of the porter class

halted in front of me, and after a military salute delivered the following address: "Sir, I am to inform you that among your baggage there is a roll of wraps with a cane and umbrella in the middle that can be drawn out; the company cannot be responsible for these, but will carry them at your risk, or will remove and bring them in here to be placed at your own risk."

Behind the train at night we could see at all times lights moving on the line, and for explanation we were informed that a patrol went over the road every time a train passed, night or day. The line is built on an embankment from four to five feet high across all plains, hundreds of miles of this, to prevent snow blockade. By the way, there is a bit of philosophy in this matter, and good philosophy too. There are no snow fences or guards, such as are seen on the lines to the southward. There is as much or more snow to contend with, but these embankments cause a break in the drift. The snow shoots over and piles up beyond, but does not stop on the railway. In the Selkirk range of mountains, where there is the same snowfall as in the Sierra Mountains, the line is kept clear by snow sheds and powerful plow engines that follow up and down during the time of a heavy snow.

Speaking of snow sheds, they have $3,000,000 worth of them on this route, all in the Pacific range of mountains. They are wholly unlike those to the south, are not snow sheds at all, but "avalanche guards." The mountains here are built on a different plan, twice as precipitous, and no one can see why the sides do not run down into the valleys. The guards consist of diverting walls in dangerous places, and in addition the sheds, which are arranged to "jump" the avalanche over the line. They have but one slope, corresponding to the mountain side, but more flat, and are made of masses of timber, strong enough to shed earth and rocks as well as snow.

In time we came to and crossed the Columbia River, to my surprise, what it is doing away around here in this part of the world a map only will explain, and navigable too. It curves away to the north, and is a better river here for steamboats than three hundred miles farther down, where it goes tumbling about over rapids that defy steamboats. Then finally the Fraser River Cañon, Burrard's Inlet, Saltwater and Vancouver, B. C. There is another Vancouver in Washington, on the Columbia River, an old fortress and not much more, but here is a city, a young one, but with many of the attributes of age, or of progress rather. Thirty-five miles of paved

guttered streets, as many miles of water pipes, and not a house in the "new town" but of brick and stone. No shanties, and none permited. It is a theoretical town, laid down at the beginning to a definite plan, and the specifications strictly adhered to. A forest here nine years ago, now quays and steamer lines to China, Japan, Australia, Fiji Islands, Hawaii and all coast ports north and south.

I learned all this before and at my arrival, and at the Hotel Vancouver had the happiness to meet my Uncle in good health and spirits, "getting his sea legs off," as he said.

——————A look around here develops the fact that there is an old or older Vancouver half a mile away, made of wood, containing saw mills, shops and a lake or pond, communicating in some way with the bay. It is a typical timber town, one of the kind that burns up clean once in a dozen years, permitting improvements and extensions. A town built with wooden houses must by the law of chances burn up whenever the houses are near enough together to permit a conflagration. It is the same everywhere, and old Vancouver has burned up a time or two. The new one will not burn up, it has been built as an investment by rich people, some of them English noblemen, who are shareholders in the Canadian Pacific Railroad. The revenues of this line are paid to the shareholders, and carried to a surplus account, now large enough, I was informed to pay dividends for four years if no farther earnings were made. I am sceptical about this, but it may be so.

——————The weather for the season was warm and comfortable; we were in the latitude of Newfoundland, about 49 north, and this subject was referred to my Uncle.

"Climate," said he, "is a water problem, the coast is what the sea makes it. Here the water is coming from the Sea of Japan, and is warm. The country is the same back to the mountains, where the wind is broken, and sent up, dissipated we may call it, takes the temperature due to altitude and descends again cold and frozen. Look at the New England coast, cold in winter as Greenland, and Great Britain, four to six degrees north of there, with a mild climate in comparison. The Gulf Stream of warm water flows parallel to the coast up to Cape Hatteras, then diverges outward, permitting the cold water coming around from the coast of Labrador and Newfoundland to wedge inside. This chills the whole country.

"The Gulf Stream takes a course across the Atlantic Ocean, sweeps past the British Isles, touching most on Ireland, then crosses

the North Sea, and switches around so as to touch Norway, not much, but enough to keep the Dover Fiord open all winter, while four or five hundred miles south of there, in Sweden, it freezes ice eleven feet thick, perhaps twenty, I have seen it eleven.

"Climate is an accident, except as governed by altitude, and even that is not a constant cause, I mean in assumed latitudes. Of course it grows hot toward the equator, but what are these little variations of temperature when not measured by our susceptibilities, less than 200 degrees, when the range in a laboratory is about 3,500. Wrought iron melts at 3,000 degrees above zero, and mercury at 38 below. Both are metals.

"We are poor weak organisms, tender as to temperature, so is all animal life, except microbes; they will endure a range of 600 degrees, so it is said. I have no acquaintance with microbes, however, and give the facts on hearsay. The fact is, and you can set it down in your notes, that there is no kind of physical fact we deal with so blindly as that of temperature. We regard one point of the scale from zero to 100 degrees as the base, and everything else above and below as abnormal. Mercury melts at 38 degrees below zero, and water at 32 degrees above zero, and evaporates at 212. Which is the normal or natural temperature of these? We happen to live, as before said, between 0 and 100 degrees, and measure everything else accordingly."

(To be continued.)

THE CHICAGO DRAINAGE CANAL.

The effect upon the Great Lakes, especially Michigan and Huron, of taking out 10,000 cubic feet of water per second to supply the Chicago canal has in some cases been thought of seriously, and as often considered a joke, but now after two or three years' discussion, and at the end of various computations, we find the Cleveland Chamber of Commerce taking up the matter seriously and communicating with the Secretary of War, also other Lake cities joining in the same movement.

The total amount of water flowing over the falls at Niagara, computed by rainfall and catchment, also by measurement in 1893, is estimated at 200,000 cubic feet per second, of which one twentieth part will be diverted at Chicago. Major Ruffner, of the United States Army, computed the fall in Lake Erie, due to reducing the flow five per cent., would be nine inches, and as this is to the present

time the most reliable authority on this matter, so a change somewhere between six and twelve inches is as certain as anything can be. It is true that other calculations made at Chicago have given five inches as the probable fall in the lake level, but there would be reasons, and strong ones too, for finding a minimum in this case.

Nine inches of shoaling, would in the many harbors of Lakes Michigan, Huron and Erie be a very important matter, even if no more than six inches. Tremendous expenditure has been made in these harbors, and in the deepening of the channel two feet, just completed by the Government at a cost of $2,000,000. It must also be considered that the 10,000 cubic feet per second required at Chicago is not a final quantity, although likely to remain so for some time. The scheme, as now laid out, is to accommodate the population of Chicago up to 3,000,000, which to any one but a citizen of that city seems final, but there are other and more pressing reasons that may arise for an additional amount of water in the near future.

The present canal is to have a depth of eighteen feet, which will accommodate navigation of our time, and no more, besides if, as assumed, the water discharged into the Illinois River will raise the Mississippi one foot at St. Louis, the great valley may become clamorous to have the drain of the lakes come down their way, as it did when the glaciers plowed out a channel that once served that purpose, and is now being reopened. There is also the Canadian side to hear from, and we will suggest that it would have been as well for the Chicago people to have more completely considered all these things before launching into their great canal scheme.

The drainage of Chicago, and the promotion of its commerce are undoubtedly important ends, but hardly so important as the extended interests affected by lowering the Great Lakes 9 inches.

OLD RIVER ENGINES.

BY AN OLD-TIME STEAMBOATMAN.

The following has been called out by some remarks in Techno's note book, published some time ago in "INDUSTRY."

May be steam engineering is a modern invention; then again may be it is not. I have seen a time when you could not make an engineer in a college; that is, could not prepare a man to handle the engines we had on the Mississippi at that day. I mean along from

1840 to 1850, and before that time, although there was not as much change those times as there is now, and a steamboat engine remained pretty much the same for years and years.

There was nothing to learn from theory or from books in those times. In fact, there was neither theory nor books available; but even if there had been, one had to learn to handle and take care of an engine by experience and hard knocks.

There were no balanced valves then, and to handle lever poppet valves was no joke. On a large boat, with valves six to eight inches diameter, you might as well try to pull out a man-hole plate as to lift one of these valves with the steam on it.

The throttle had to be run down whenever you unhooked, and there were by-pass pipes in case you got caught with a cylinder full of steam and the exhaust valves held down with three to five tons on them. We carried from 120 to 150 pounds of steam, cut off when under way at half to three quarter stroke, and one could hear the exhaust five miles in every direction. The cylinders were mounted on wood the same as now; the connecting rods were of pine, that is, were filled in with pine wood, and the pistons packed with hemp, braided from nine strands and hammered in, so it took fifty pounds of steam to turn a wheel over when the packing was first put in. It soon got loose however, and then wore well for fifteen or thirty days by setting up a few times.

There was no boiler margin those times. The engines would work off all the steam that could be made, no matter what kind of firing was done. If steam went down we throttled the engines until it came up again, in fact we ran throttled all the time except in a race. Then we left the engines, and went around to the fires. We could have burned kegs of kerosene. as we did bacon, pine knots, anything except gunpowder, and the engines would work the steam off. No fear of that.

As I have said, to have the care of an engine and boilers those times was no easy matter, and experimenting was dangerous. We saw, felt and absorbed the thing. It took courage too and skill, with hands, head, and sometimes feet also.

Along about 1848, I think it was, I was striker on the *Duchess*, an "Orleans tub," that's what we called the boats built to go through the canal locks at Louisville. They had to be within 185 feet long, and to get cargo into them they were deepened and widened until they looked swelled up like Noah's ark. Awkward looking boats they were. You could tell a "tub" as far as you

could see one. No good boats came above Louisville, that is no large boats, unless now and then one would crawl up over the falls, taking good care to get back again before the water fell too low.

There were good boats above the falls, the finest lines anywhere. The Cincinnati and Pittsburgh and Ohio and Baltimore lines, seven boats in each, about 300 feet long, that would run from 16 to 18 miles an hour. The Baltimore and Ohio Railroad ended at Wheeling, Va., at that time. Then there were the Louisville lines, still better boats, the *Ben Franklin* and *Telegraph* for example, and the *Northerner* and *Southerner*, low-pressure boats with cylinders 64 inches diameter, but these failed. The ponderous condensing engines were taken out and replaced with the common type.

Before coming to the *Duchess* I want to say a word more about the falls of the Ohio. This river is one of the finest in the world, flowing in a quiet way for more than 600 miles between two ranges of low hills that approach first on one side, and then the other. There are numerous bars or slight rapids, but good behavior on the whole until the falls at Louisville are reached, and then this quiet river tumbles down about forty feet in three miles.

Here the Government made a canal at Louisville, with locks big enough it was thought for all possible future craft, but that was a mistake. The length, as I said before, was 185 feet, and, as before explained, to that gauge were the old Cincinnati boats limited.

The *Duchess* was a refinement on most of them, thinner forward, and leaner aft. She was a kind of fancy packet among the "tubs," full powered, did not carry much freight, but plenty of passengers. I became striker, or fourth engineer, on the *Duchess* by accident, when quite a lad. The carpenter, who had been standing the watch, became ill. I was a passenger and volunteered.

The *Duchess* failed to get a trip up from New Orleans, and bargained to tow two barges loaded with railway iron from New Orleans to Lawrenceburg, Indiana, close on 1,500 miles. There was 700 tons on the barges, and 300 tons on the boat, making in all 1,000 tons, which for that time was a wonderful cargo.

We pounded along, running points and bends to Memphis, about half way, and stopped there to clean boilers and overhaul. The starboard engine had crawled around on her moorings and the chief had us take out the piston, and put a line through the cylinder to straighten the slides. The piston was for convenience carried out on one of the barges alongside, and in the sunlight we saw that the head was cracked, from the cedar filling no doubt. Few people at

this day will know what that means, perhaps they should not. The piston was a cast iron cylinder about ten inches long with eight flat radial webs between the shell and hub. To prevent steam getting into this cavity the interior of the pistons were filled with red cedar wood driven in tight, and when this swelled the whole was a solid mass, but not heavy.

The engineers held a confidential council over the piston, and concluded to put it in again, and to not mention the matter to the captain. I saw all, and heard all, but being a boy was not consulted. About one hundred miles above Memphis that piston raised a commotion. It broke up, jammed the forward cylinder head off, turning the bolts out like hooks, then went back and jammed against the after head, sheared off the key through the piston rod, so that when steam entered that end the rod and part of the piston head shot out, and after cutting off a stanchion went through the "doctor," and then through the sheet-iron furnace covering, bringing up under the middle boiler. The second engineer had a hand smashed, a deckhand was scalded, and general confusion.

The *Duchess* could not hold 1,000 tons against the Mississippi current with one wheel; we headed for the bank, and tied up to the timber. The chief and third took the broken piston in the yawl and started for Memphis, 100 miles away down stream. We laid there a week in the wilderness, cut down bee trees, shot pigeons, fought mosquitoes and studied "Arkansaw life." Fifteen miles back there was a planter. His "niggers" found the boat. The planter came out to sell some wood that he had near. He furnished sixty cords, and drank out the whole account at the bar. He said: "money was no good there any how." We brought some of this cottonwood all the way to the falls of the Ohio, and burnt it there with pine knots and coal to come over the rapids.

There was nine feet of water, and the steamer fell off half of her speed, because of the inclination of the water on the brink at the top of the falls. We stood there four hours, swaying from side to side, and finally went over with a thousand tons of freight, the greatest feat on record, which was duly celebrated by firing and bursting an old cannon that happened to be on board. The tops of the bridge walls were melted off, the boiler deck set on fire several times, and everything strained up to the point of rupture. It was a tough trip, and seems to me only yesterday instead of forty-seven years ago.

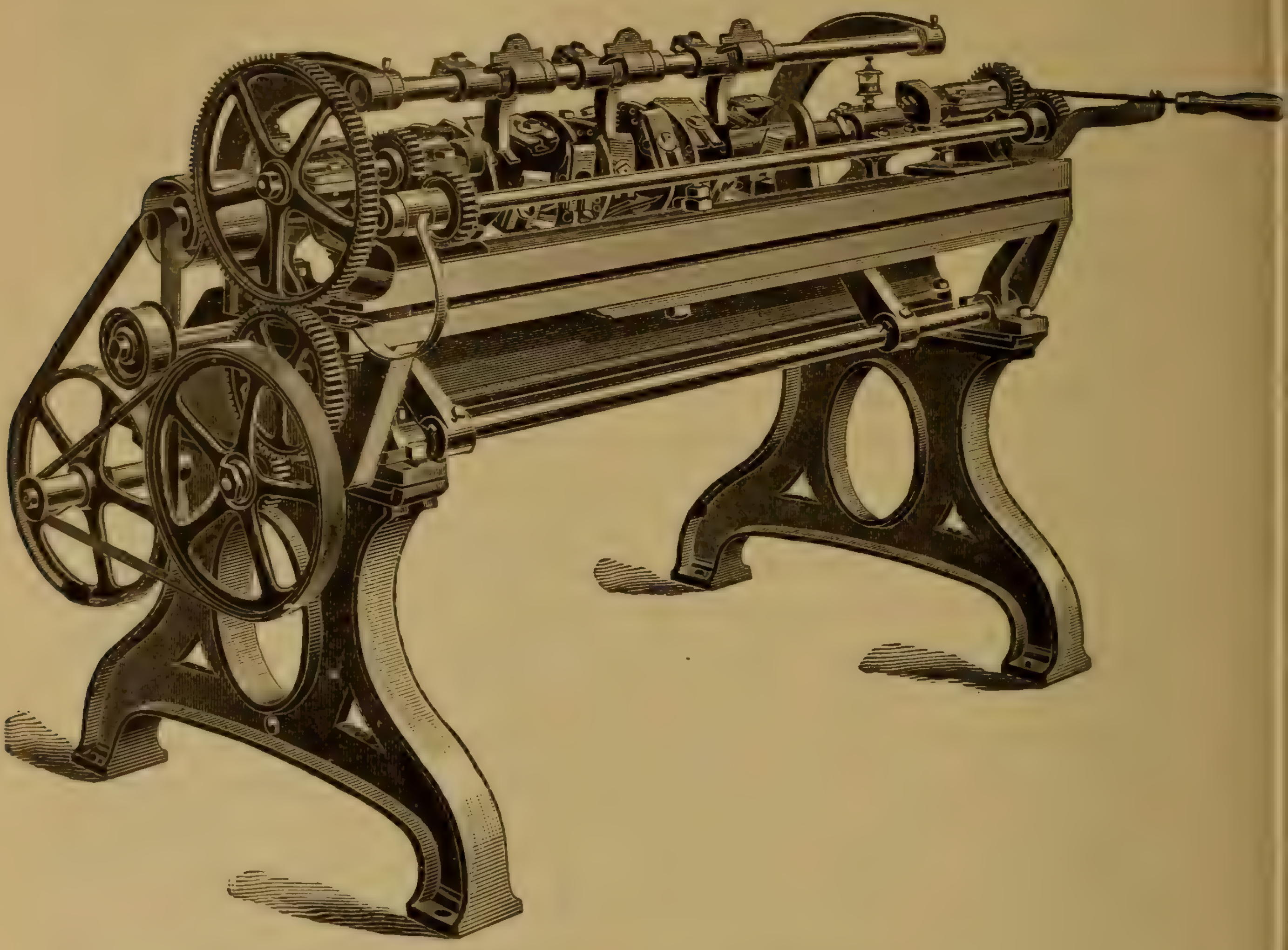
We had compound engines on some of the boats in those times, same as now. The *Memphis* was one boat fitted up this way. The

cylinders were 16 and 30 inches bore, set tandem in the middle of the boat, the wheels being clutched at each side, and a flywheel in the middle. It was a dangerous rig. In bad landings two firemen were sent to the clutches, and if a miss was made the engines ran away, and all the valve levers were in the air at once. The *Hawk-eye*, an older compound boat had such an accident, threw her fly-wheel down through the bottom of the boat, and then followed it, in thirty feet of water, as described by Techno in one of his notes.

The *Clipper No. 1* was I think the first compound boat, built about 1840, or sooner. *Clipper No. 2* was also a compound, still we are told that compound engines are new.

Boilers were of thin iron, one fourth to five sixteenths inches thick, of small diameter, thirty-six to forty-two inches, usually with two flues. Cylinder boilers went out before my time, except a few around Pitts-burg, where I dare say there are some yet, and perhaps ought to be. They are cheap, so is the fuel, and when thirty feet long and well set they are by no means wasteful. We used steam blowers for draught. They were simply pipe nipples projecting into the rear ends of the flues. We made them ourselves by taking a piece of gas pipe, and flattening down the end on a piece of tin or thin iron that when drawn out left a thin slit across the end. The draught made in this manner was almost without limit.

I could go on and explain how we climbed over bars, and got out of various scrimmages not known in our day, also how now and then a battery of boilers would "go up," tearing a boat to flinders, scalding, drowning and crushing hundreds. It was a strange life, soon to pass into oblivion, only heard of as recalled now and then by old men who participated in the art forty to fifty years ago.



LATHE FOR IRREGULAR FORMS.

THE OBER LATHE CO., CHAGRIN FALLS, OHIO.

The engraving shows in perspective a machine for turning or shaping irregular work, which seems quite a departure from common practice in this country.

These lathes are employed in making tool handles, such as those for axes, hammers, and picks; also wheel spokes, whiffletrees, and the like. They will produce round, oval, polygonal, or square sections, and it is said will produce from 200 to 500 short pieces, or 200 to 250 wheel spokes in an hour, ready for the sand belts that follow.

These machines belong in the class called "copying," producing duplicates from a model, not necessarily the same in size, but having like relations in respect to diameters in the cross section each way. They present some curious problems in working and are a product of experiment rather than of calculation.

There are two pecular features: the elastic element that enters into the vibration to produce oval or other irregular cross sections,

and the inertia of the piece being cut, or of the piece and its supports. The first is required to produce the rythmic vibrations without jar, and corresponds to crank motion, so the vibrations can take place with great rapidity. No one would suppose, inferentially, that a piece of oval section, for example, would "follow" a pattern at fifty to a hundred revolutions per minute, but this is what takes place.

Again, if we imagine a thin piece, like an axe handle or a long carriage spoke being struck by the cutters, it will seem that its rigidity would not oppose such a force. This is provided for by making the cutter heads of large diameter, and giving them a very high velocity at the periphery, so the "time" of contact, measured on the arc, is infinitesimal, and the inertia of the wood, with what are called "back-stays" of some weight, immediately opposite the cut, prevents yielding of the wood and produces tolerably smooth surfaces.

The machines, of which a middle size is shown in the engraving, seem to involve a good deal less detail than the old type, and are certainly more accessible and simple in construction.

The company confine themselves to irregular turning machinery and the finishing apparatus required therewith, consisting of sanding, polishing, and "waxing" the work.

THE TECHNICAL SOCIETY OF THE PACIFIC COAST.

This Association held their regular monthly meeting on May 3d, the President, Mr. G. W. Dickie, presiding.

The following new members were elected: Walter E. Downs, C. E.; Jno. B. Leonard, C. E., and Franklin Riffle, C. E.

The paper for the evening was upon the "Reconstruction of the Ferry Transfer Slips at Port Costa and Benicia, Cal." by Mr. J. B. Leonard, C. E., member of the Society. This paper was discussed by a number of the members present.

This paper, which is to a great extent graphic, and for that reason does not admit of a synopsis, deals with the constructive features of the new swing aprons at the slips in Benicia and Port Costa, where the traffic of the Central Pacific Railway crosses the Straits of Carquinez.

This transferring is done on the immense steamer *Solano*, of 3,500 tons register, 424 feet long, and 64 feet beam, the decks being 116 feet wide. The steamer is now undergoing extensive repairs

at Oakland, after a continuous service of sixteen years, and while the vessel is being repaired the slip aprons are also being reconstructed to meet the very changed conditions of the traffic, both in nature and volume, from sixteen years ago.

These latter-named changes form the subject of Mr. Leonard's paper, which is a clear and complete description of the work, and a review of the conditions on which the various dimensions and values are based. The weight of locomotives, for one thing, has been doubled, and that of other rolling plants much increased, calling for added strength in the swinging aprons and all supports.

The work, as carried out, reflects much credit on the engineering staff of the road, and it will no doubt serve for another decade to come, unless the Straits are bridged within that time, which is by no means improbable.

STEAM-ENGINE EFFICIENCY.

The following is an extract from the *Engineering Review:*

"Among the many changes which the development of electrical power is bringing to pass, not the least notable is the economy of power in our factories, workshops and mines. A fairly-good engine will waste over 90 per cent. of the energy of the steam that it receives, so that only the remainder will be converted into useful work. If, however, a good dynamo or motor is properly loaded it should have an efficiency of about 80 per cent. Many attempts have been made to raise the efficiency of the steam engine, but few of these have been successful." * * * * * * * *

One in reading over such remarks as the above must conclude that Mr. Jeans is a little careless respecting contributions to his journal.

A steam engine is a prime motor in the usual sense of that term, but a dynamo or electric motor is nothing of the kind, but is a machine of transmission, and remarks like the above are misleading. In so far as primarily driving a factory, a dynamo or motor would be of no more use than a grindstone, and how any other idea should exist is a mystery. If the writer above quoted had argued that water was preferable to wood, or that coal was preferable to iron, he would have been laughed at, but to assert that an electric motor is preferable to a steam engine, an equally absurd comparison, goes unchallenged, but this is not the only absurd part of the statement quoted, "a fairly good engine wasting ninety per cent. of the energy of the steam it receives" is not a point to be argued. It would not be half true if fuel instead of steam had been named.

AMENDMENT OF THE BRITISH PATENT LAWS.

There is now before Parliament a bill to amend the patent laws that will have much interest to applicants from this country, and is logical and just as will be seen.

There are eleven articles in the bill, of which we quote the substance that most directly effects the interests of applicants.

"No letters patent granted to the first and true inventor of any invention shall be held to be invalid by reason of such invention or any part thereof having been published prior to the date of such letters patent, provided that such publication was made inadvertently or without his knowledge and consent, and that the matter of the same was derived from him, and provided that he applied for and obtained protection for his invention with all reasonable diligence after learning of such publication in case it came to his knowledge prior to the date of such letters patent.

Any person or persons who have obtained provisional protection for an invention may at any time prior to the acceptance of the complete specification file supplementary provisional specifications in respect of developments or improvements invented by them, or any of them, of the invention of which such protection was originally granted, and any such supplementary provisional specification shall have the same effect as to protecting such inventions as if it were a provisional specification of like date.

After the grant of letters patent no objection shall be allowed to the validity of the same on the ground of disconformity between the complete specification and the provisional specification.

No letters patent shall be held to be invalid by reason of any prior publication or user at a date more than fifty years prior to the date of such letters patent.

Section 4 of the Patents, Designs and Trade Marks Act, 1885, shall be amended by adding thereto the words 'until the expiration of three years from the date of such application, and no such publication shall be deemed to be a prior publication so as to invalidate any subsequent application for letters patent.'

Where a complete specification contains more than one distinct claiming clause the patentee may at any time by notice in writing to the Comptroller disclaim any one or more of such claiming clauses, provided that no such disclaimer shall be made which would leave the specification without at least one distinct claim."

THE FOLSOM WATER POWER COMPANY AND SACRAMENTO ELECTRIC POWER AND LIGHT COMPANY.

VIEW. SHOWING DAM AND COMMENCEMENT OF POWER CANAL.

This great work is by no means a new one so far as the water power is concerned. It was commenced in the early sixties by the Natoma Water and Mining Company. The credit of its inception is due to the late Hon. H. G. Livermore, President of the Natoma Water and Mining Company, a pioneer, who, born in the State of Maine, and reared where every stream gives up its power for the benefit of manufacture, early saw the advantages of the American River at Folsom for such a purpose.

The first intention was to utilize the power at the town of Folsom, and there erect extensive mills, but the recent and rapid advancement in electrical devices for the transmission of power by electricity has rendered it possible to send the power produced at Folsom over wires to Sacramento.

The dam, canal and permanent works of the Folsom Water Power Co., at Folsom, Sacramento County, California, have been finished for several months. The company has now entered into a contract with the Sacramento Electric Power and Light Co., transferring

to them the total power resulting from the fall of the water flowing in the line of their canal, save what is reserved for the State of California in return for labor furnished in the construction of the canal.

This transfer of power to the Electric Company amounts to many thousand horse power, and the Electric Company have contracted with the General Electric Company for the installation of a power plant, and double transmission lines to convey 4,000 electrical horse power from Folsom to Sacramento. This power will be distributed for propelling the electric car lines of the Sacramento Electric Power and Light Company, for lighting and general power purposes.

The power houses at both Folsom and Sacramento are now in course of erection. The transmission line is nearly completed the whole distance, and all must be finished and in operation by the first of July next.

The dam, canal and power house are built in the most substantial manner, requiring more than 25,000 barrels of the best Portland cement in their construction. The dam is 89 feet high, 24 feet wide on top, 87 feet wide on the bottom, and the dam and head works are upward of 650 feet long. A heavy granite wall built from the bed rock, and 8 feet wide on top, forms the outer border of the canal for a long distance at its upper end, and the inner side of the outer bank is protected by a facing of masonry most of the entire length.

The canal of the Water Company is 50 feet wide at the top, 40 feet wide at the bottom and 8 feet deep, flowing 85,000 cubic feet per minute. The fall at Folsom is about 80 feet, but only 55 feet of this head will be applied on the wheels, the water being discharged 25 feet above the bed of the river, so the water can be led into an irrigating canal extending to the plains between Folsom and Sacramento, and irrigating a large area thousands of acres in extent.

The electric transmission is, next to that at Niagara, the most extensive in this country. The distance of transmission is twenty miles, and the works are to be completed by the first of July, 1895. The water wheels, eight in number, are of the pressure type, made at York, Pa., by the S. Morgan Smith Company, arranged in pairs, each pair of wheels generating 1,260 horse power at a speed of 300 revolutions per minute under a head of 55 feet. Separate wheels are used for the exciters, and regulation effected by means of a Faesch and Picard governor acting on the induction issues of the wheels, also by heavy flywheels on the water-wheel shafts.

The generators will be connected directly to the water wheels,

FOLSOM WATER POWER COMPANY.

VIEW ABOVE THE DAM AT FOLSOM, CALIFORNIA.

and are of the three-phase alternating type, four in number, each of 1,000 horse power, and to weigh 30 tons, to operate at 800 volts. This pressure or voltage is raised for transmission to 11,000 volts, and the lines with all accessories arranged for this high voltage. The whole of the electrical equipment is supplied by the General Electric Company, including generating, transmission and distribution. The poles, 2,600 in number, to support the wires are of cedar, 16 inches diameter at the bottom, 40 feet long, having at the top cross bars to support the two circuits.

The whole plant is arranged in duplicate. The forebay to the wheel is double, so that one side can be shut out for cleaning if necessary without stopping all the wheels, and the transmission line is also double, consisting of two lines of poles, one on each side of the county road all the way from Folsom to Sacramento, thus making it possible to shut the current from either line in the event of repairing, or for other purposes.

In the generating and also the receiving houses, the switches are so arranged that all the machines are interchangeable. The receiving house in Sacramento is a large two-story building, entirely fireproof, as is also the building in Folsom. In the upper stories are installed the step-down transformer, with necessary switches, and in the lower story are installed the railroad motors, the light machines, power motors, etc., with all the necessary switches for operating the same.

We are unable to do more than give these general particulars of this remarkable plant for power distribution, the first of large size on this Coast, but doubtless only a precursor of others to follow. The elements entering into this work will better than the description above convey an idea of its extent.

The cost of constructing the dam, headwork and canal, was $1,217,363, involving 700,000 days' work of convict labor, provided by the State. Material, expense, etc., as follows:

23,000 bbls. of Portland cement	$69,418.95
Sand and gravel for concrete	6,660.95
Construction machinery	25,000.00
Fuel for locomotive, hoisting engine, drills, etc.	20,178.87
Explosives	8,273.44
Gate machinery	25,838.19
Railroad	16,595.78
Engineering	21,490.95
Lumber	4,595.91
Buildings	1,046.08
Materials, tools and steel	35,522.80

The dam and headworks contain 37,000 cubic yards of granite masonry, and the excavations measure 12,000 cubic yards.

It should have been mentioned that there are two canals, one on each side of the river, the principal one being on the eastern side. This latter is divided into three sections; the first section extends from the dam to a point just below the first or State fall, which is a drop of $7\frac{33}{100}$ feet. This section is cut much of the way into solid granite cliffs, the rock from this cutting going, however, most of it into the dam and headworks on the east side, and into a heavy masonry wall 8 feet wide on the top, and in some places 30 feet high, built on the bed rock, and which forms the outer bank of the canal. In this section four sand gates are provided. This section is about 2,000 feet long.

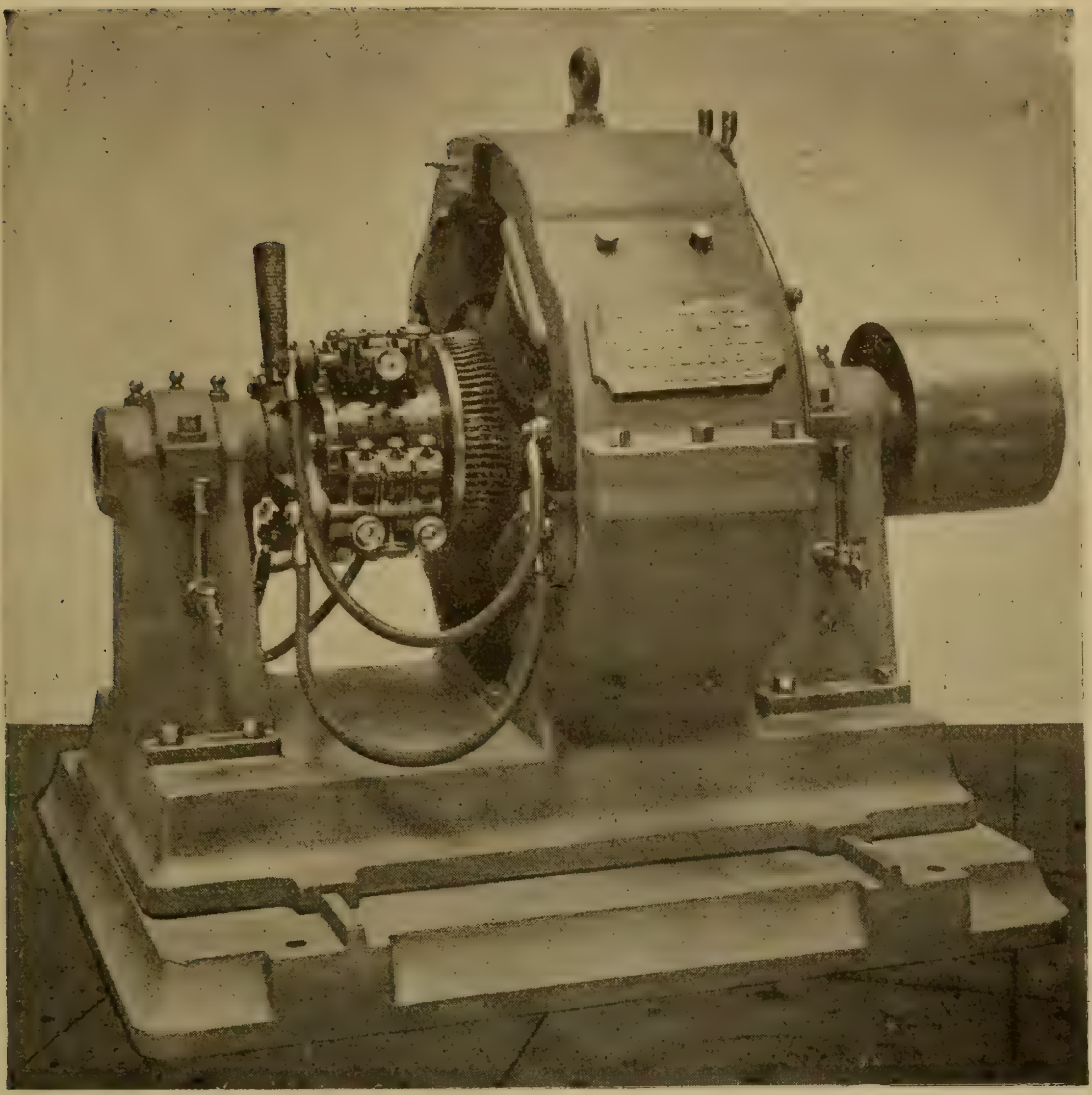
Section 2 is constructed with an outside bank, earth and rock filling, on which is laid a broad gauge railroad track. At the lower end of this section are located four deep outlet gates, raised and lowered by hydraulic cylinders. The outer bank of section 2 is faced on the inner side by a masonry wall, and the outside facing of the bank is protected against the river by a heavy rip-rap. Section 2 is 4,000 feet long.

Section 3 is made by earth and rock excavation, and an earth rock bank-fill, forming outer bank of canal, which, as in section 2, has a railroad track on top. The bank is protected on the outside by rip-rap, and in some parts of the inside faced with dry rubble wall. Section 3 is 3,500 feet long, making a total length of canal 9,500 feet.

Above the head gates, the east canal is 66 feet wide, at the upper end of section 1, below head gates to State fall, it is 53 feet wide on top, and 45 feet wide on bottom. Sections 2 and 3 are 50 feet wide on top, and 40 feet wide on bottom, carrying water 8 feet deep, with such a grade as to afford a flow of water in the canal of more than 85,000 cubic feet per minute.

The Folsom Water Power Company was incorporated October 14, 1881. The officers of the company are:

Chas. E. Livermore, San Francisco, President; H. P. Livermore, San Francisco, Treasurer and Manager; Joshua Barker, San Francisco, Secretary; H. T. Knight, Folsom, Engineer.



MULTI-POLAR DYNAMO.

THE ELECTRICAL ENGINEERING CO., SAN FRANCISCO.

Our readers will remember that in No. 79, for February of this year, we published a description, by Mr. E. A. Rix, of this City, of the dynamite gun batteries to be erected here for harbor defense.

The contract for the electrical generator was awarded to the Electrical Engineering Company, who have prepared the one shown above, of forty kilowatt capacity. The current is employed to raise or range the dynamite guns, and is applied by electric motors connected with the mountings. The dynamo is from a new design, especially prepared for the purpose, but corresponding in most respects to the Company's latest practice. The engraving is so clear that farther description is not necessary. The Company are adding various things to their regular manufactures, among other things motors and gearing for elevators, fitted with improved controlling devices.

LITERATURE.

The Technology Quarterly.

VOL. 8, NO. 3, OCT. 1895.

The above number of this publication comes to hand with its first article of twenty-one pages forming a refutation of the common but not disparaging charge of the *Quarterly* being a "laboratory work."

The article is entitled "Some Experience in Engineering Practice," by the Hon. George Duncan, C. E., late of the firm of Maudsley Sons and Field, Engineers, London, and by any fair standard is one of the most valuable contributions to constructive engineering literature that has appeared for a long time. The paper is in substance a lecture delivered by the author in England, revised and contributed to the Institute of Technology, in June, 1894.

It is intensely practical, as the title declares, and follows over the field of marine engine construction in a manner devoid of pedantry, and indicating complete practical knowledge of the various processes of manipulation in a lucid and interesting way. This paper brings to mind the fact that even in the great firm of Maudsley Sons and Field the partners are practical men, and that skilled industries, or at least those of an engineering nature, are founded there on skill instead of money. A maker of marine or other engines must be an engineer. If he puts capital into a business he is paid for its use; if some one else furnishes the capital it is the same, the partners are to furnish not money, but as we say "brains."

There is therefore nothing strange in Mr. Duncan's lecture, which ends as follows:

"In addition to all I have written above, I can quote the lower motive of self interest as a forcible argument, for there are numberless positions from which the lack of a workshop training would tend to exclude you. No large ship owner, nor other man in a responsible commercial position, can afford to run risks in the choice of a man who is to have a great charge. He will wisely prefer the so-called practical man, even if he is no genius, to any man lacking real practical experience, no matter how able or scientific he may be.

You must remember that the workshop-trained, unscientific, but practical man cannot avoid absorbing a good deal of what I may be permitted to designate as 'practical theory and science' by simply observing what surrounds him when he is at work in shops or the engine room, hence this man is not really devoid of science, and although his theoretical knowledge may be narrow, yet he will not be averse to move on steadily and cautiously. Such a man has no mean value, commercially speaking. It needs no further words of mine to demonstrate the beauty and the value of combining science with practical experience."

The Journal of the Franklin Institute.

NO. 832, APRIL 1895.

The above-named number of the journal is special, and of much interest. It contains one hundred pages, including a history of the Franklin Institute, compiled by Dr. W. H. Wahl, the Secretary.

This institution, now a venerable one for this country, was founded in 1824, seventy-one years ago, and now stands as an *alma mater* to more successful mechanics than any association of the kind in the United States.

Philadelphia has always been a center of the mechanic arts in their highest development, mainly because of rational encouragement given to the founding of skilled industry there. The old pioneers, two centuries ago, perceived clearly a lesson we are now busily learning, that tools and the implements of trade were not a proper subject for taxation. Old Matthew Bolton's precept, "Tax wealth wherever found, tax the spending of it, but do not tax the getting of it," was and is the policy of the Quaker City.

Dr. Wahl's history of the Institute, too long for even a synopsis here, contains many useful suggestions and landmarks for other efforts in the same direction, and comes opportune, because at this time there is being considered a scheme of erecting a new building to cost a million and a half dollars, the plans of which are now prepared. We hope to publish a drawing of this building, and the main features of its arrangement, as soon as the matter assumes tangible shape.

The regular proceedings include an account of the celebrated "Redheffer Per-

petual Motion Apparatus," by Prof. Henry Morton, President of the Stevens Institute, and past president of the Franklin Institute; "The Progenitor of Keeley's," and others. There is also a lecture of much interest by J. Y. Schemerhorn, C. E., on the "Rise and Progress of River and Harbor Improvement in this Country." Another paper of interest is that of D. Thos. M. Chatard on the "Natural Soda Deposits of the United States."

Transactions of the American Institute of Electrical Engineers.

APRIL 1895.

The principal paper of the April meeting was one by Professor E. J. Houston and Dr. A. E. Kennelly on "Resonance in Alternating Current Lines," a learned, careful essay directed to the following objects:

"(1) To present the formula expressing the variation of electric current and pressure in an alternating current circuit under the most general conditions, and in its simplest form.
(2) To present calculations for the pressure and current in any alternating current circuit by a graphical method.
(3) To investigate the effects of static capacity in an alternating current circuit.
(4) To investigate the effects of capacity and inductance on the delivery of energy at the distant end of a circuit."

This is what may be called an advance paper that lies an inconceivable distance beyond all we can hope to learn of electrical science in a popular way, hence cannot be criticised here. One of the graphic delineations is amazing, not much less so its description, beginning with these terms:

"Plate 1 is intended for the purpose of giving by inspection the polar co-ordinates of a vector point, representing the hyperbolic sine or cosine of a given vector, whose rectangular co-ordinates x and y are known."

The principal inference to be drawn from such a paper, aside from useful practical conclusions given at its end, is that electricity has become a "science" in the full essence and meaning of this term.

Mr. Wm. A. Anthony presented a short paper on "Underwriter's Rules," which with a paper on "A Method of Preventing Armature Reaction," by Prof. H. J. Ryan, and its discussion, make up the present bulletin.

Elasticity a Mode of Motion.

Mr. Robert Stevenson, C. E., of this City, has on several occasions presented in a compendious way a theory of the kinetic stability of matter in motion, and now in a more extended form under the title above has collated some previous work and presented his propositions in what may be called a tangible form.

The author's propositions, while they have awakened a good deal of interest, at the same time met with incredulity, and often with rejection at once on the assumption that the theories presented controvert the law of gravitation as established by Newton, and the basis on which rests the accepted theory of the relations and influences of matter.

We do not so understand the author's propositions, but as an explanation, where explanation was wanting before, of what we "call" the law of gravitation—theories resting on a rational and computable basis, verified by various phenomena that are not explained by the assumed fundamental principal of gravitation, or the attraction of matter.

The law of gravitation, that is, the assumption that each particle of matter attracts all other particles of matter, not only fails to satisfy the mathematical conditions of science, but also fails to explain simple phenomena, as everyone knows. A spinning top, a gyrascope or a bicycle are familiar illustrations, explained as "the tendency of bodies to continue in one plane of motion," but this is no explanation at all, is only a name for observed phenomena. No one can say, or at least no one has explained, why the law of gravitation should or could cease to act on a spinning top or a gyrascope, or in any other case of bodies moving at a high velocity.

Mr. Stevenson's theory, as well as his computations relating thereto, seem to completely satisfy these and other problems that lie outside the assumed law of gravitation, or the physical principles we call by that name.

We do not make a pretense of understanding the complex conditions that arise out of the laws of motion and matter, but must contend that an engineer of high standing, trained in the University of Glasgow under Sir. William Thomson, is not

likely to present any theory relating to physics not entitled to careful attention.

There is in the flight of birds, and the trajectory of shot, certain phenomena that have long puzzled scientific people. There is also in centrifugal pumping, as well as in the familiar examples before named, something not before explained, but apparently solved in a simple manner by propositions here presented.

The book is written in a plain perspicuous way adapted in the main to popular reading, and unlike most treatises of the kind is extremely interesting. We commend it to the readers of "INDUSTRY," and will be glad to publish opinions and criticisms sent to the editor.

The work contains sixty-one pages, finely printed on good paper, by the Industrial Publishing Company, 40 California St., San Francisco. Price, in paper cover, 50 cents.

Transactions of the American Society of Mechanical Engineers.

VOLUME XV.

We are indebted to the courtesy of Prof. F. R. Hutton, the Secretary of the Society, for the above volume of 1,360 pages, containing the papers and transactions of the New York meeting of 1893, and the Montreal meeting of 1894, embracing fifty-one distinct papers with the discussions thereon, besides much other matter of a statistical nature, and a complete index of the Society's publications since 1880.

The present volume gives rise to two principal thoughts, the phenomenal growth of the Society, and wonderful progress made in the branch of engineering service to which it is devoted.

It has been in late years only, that constructive processes have to be set off as a branch of engineering, not as a matter of design, but as a natural consequence of evolution. The rapid growth of the American as well as other societies of like nature in other countries shows that the classification of mechanical engineering was far behind the fact of such distinction.

It became apparent about twenty years ago that most important elements in engineering science pertained to its dynamic branches and constructive processes; that static structures of all kinds had fallen within the field of computation, and that research for the future must be more and more confined to machine motion.

The nature, construction and operations of machines were found to be so intimately connected with human industry, transportation and subsistence, and scientific attention was in a wonderful degree turned to what we call mechanical engineering. To this fact can be attributed the rise of the American Society, now numbering nearly 1,700 members, and possessing all the elements and accessories of a continued and increasing growth in future.

We cannot, of course, consider or even present a list of the various papers included in the present volume. They cover a wide field in the constructive arts, diverse in nature and objects, but always containing new and useful facts and suggestions.

The volumes of transactions are sold at certain prices in proportion to their size, and form a standard library of reference for practicing engineers. The Society's office is at 12 West Thirty-first Street, New York.

Nystrom's Pocket Book of Mechanics.

Twenty-first Edition.

J. B. LIPPINCOTT CO., PHILADELPHIA.

This pocket book, adapted especially for the use of mechanical engineers, is too well known to call for either description or an opinion of its merits, but admits of remark in some other respects.

No other among pocket books has so little of what may be called compilation. Mr. Nystrom, whom we had the honor to know personally, was a native of Sweden, and came forward nearly contemporaneously with the Ericssons. He was a man of great mental qualifications, and in some respects eccentric, given to abstruse research apparently to satisfy a natural propensity, and without any object of a business nature. Among such studies was that of astronomy, in which he took a great interest and was an authority.

The pocket book indicates his originality, even to terms, such as "longimetry," and "planimetry." It is unique in some respects and devoid o' pedantry, although he had great confidence in mathematical methods, and says in his original preface:

"The solution of mathematical formulas leads to powerful presumptions in the revelation of physical laws, which could never

be attained or realized from mere observation of facts in experiments and practice. All observation and contemplation which involves mind, involves theory, which is the foundation of our practice and progress."

There is revision of the work in various ways in the present edition, by Mr. R. Grimshaw, and its execution in all the publishers contribute is exceptionally fine. 675 pages, 6 × 4 inches, in leather, with tuck and pockets. Price, $3.50.

Consular Reports.

United States Consul J. C. Monaghan, writing from Chemnitz, Germany, to the State Department, gives a description of chain rolling there that seems to be fully successful, and if so it will cause before long a good deal of disturbance in the ordinary lines of this extensive manufacture.

The chains are rolled, or formed rather, from bars of cruciform section at a rate of ten to twelve feet a second, the metal being at a white heat. The scheme is not new, it has been a problem for some years past without having reached a successful issue, but there is nothing strange in improving the process at Chemnitz, which is a center for implement making in Germany. The machinery as described is the same as the original idea, that of rolling surfaces having pitched dies and cutting edges, but is very expensive.

Methods of Mine Timbering.

BY N. H. STORMS, E. M.

Among the publications issued by the California State Mining Bureau last year is the one above noted. It is in the form of a bulletin of fifty-eight pages, which greatly contributes to its usefulness and convenience.

The work is confined to practice in the mines of California, and will be a matter of astonishment to those unfamiliar with this work, carried on under the earth and hid from observation. It is a whole art by itself, even what is here described, and it will be no disparagement of other publications of the Bureau to say that the present is one the most useful ever prepared.

Various forms for timber framing has for centuries past formed a kind of puzzle for engineers, the object being to dispose the material so as to receive only end strains.

Metals being homogenous, or nearly so, do not involve like problems, and are simple to dispose in framing of any kind, but timber is quite another matter, having but little value transverse to the fibre, even in the way of resisting flexure. Coherence is a quality almost absent in so far as strains, such as are encountered in mine timbering.

The author has not pointed out features of novelty, if such exist, as they undoubtedly do in the methods here presented, hence the value of the report to students must be determined by comparison with other practice. This should have formed a part of the present work, or at any rate the especial points of value would have assisted in such comparison. Of course methods vary with the nature of the work, the kinds of timber and facilities for preparing it, but the main part of all is what is new in the various plans, here set forth in admirable form, both graphically, and in the text.

List of Merchant Vessels in the United States, 1894.

We are indebted to the U. S. Commissioner of Navigation, the Hon. Eugene Chamberlain, for a copy of the above list, a bound quarto volume of 450 pages, containing a vast amount of information respecting our National marine, admirably arranged and of value as a reference. The title includes only merchant vessels, but the lists cover the navy as well, the latter being classed in nine divisions, such as Revenue, Quartermasters' and Engineers' Service, the Fish Commission, Lighthouse Service, and so on.

There are given the code signals and the National flags of this and other countries in their proper colors, also thirty-three plates of noted and typical vessels in this country, and a list of books on navigation and charts useful for various waters.

We have had occasion several times since the appointment of Commissioner Chamberlain, to remark upon the intelligent interest taken in our marine affairs, and his breadth of views compared with some of his predecessors.

The bulletins sent out of the Bureau in the two last years have done a great deal by instructing the people in the true state of our national shipping interests. No such claim can be made for previous years as far back as can be remembered.

Local Notes.

Mr. J. P. F. Kuhlmann, C. E., of this City, recently erected in Providence, R. I., one of his counterweighting devices to compensate the gradients on the College Hill Street Railway line in that city. The plant is analogous to that erected by Mr. Kuhlmann at Seattle, Washington, and at Portland, Oregon, and has for its object balancing or compensating the ascending with the descending traffic. There is a conduit under one line to accommodate the balancing weight of about 12,000 pounds, that is mounted on wheels, and runs on ways in the bottom of the conduit. To this weight is attached an endless cable that is gripped by the cars in ascending and descending. On the down grade one car draws the balance weight to the top of the grade, and the next ascending car is balanced by the weight descending, so the grade is practically eliminated, and the common means of propulsion are sufficient irrespective of inclination.

The recent advance in the price of petroleum oil is entirely inconsistent with the circumstances of trade, and simply means that the long-delayed schemes for international combination are now in a measure completed by the Standard Oil Company and their allies. This scheme of international alliance or combination has been one of much difficulty, and has consumed at least a dozen years, but the circle is now complete, and the band is beginning to be tightened. There was a little leak through the combination lines here at San Francisco by the importation of Peruvian oil, but the Southern Pacific Company, in combination with the Standard Oil Company, stopped that leak with a duty on coal oil; smuggled through Congress, and without the least object in any part of the United States except here in California. Like the coal tax, another of the same kind, it is special for San Francisco, where seven eighths of the coal tax is collected. Considering the enormous use here of petroleum for lighting and power purposes some expression of opinions, if nothing more, is due from the Manufacturers' Association.

Anent the rise in the price of coal oil comes a manifestation of the "Pennsylvania idea" in economics. Our exchanges, some of them, are much pleased over the activity that has arisen in the oil

country, due to an increase in the price of oil, never thinking of those that use the oil, or nine tenths of the whole population in this country, nor of the farther fact that the profits derived from the increased rates accrue to a corporation that has no need of the money. A rise in the price of some other commodities of wider production would be a much more desirable fact, but even that by an international "cinch" is not a consummation to be prayed for. It is to be hoped that the Russian Government will not permit the existence in that country of a forced tax, drawn mainly from the wants of the poor to enrich the Nobel Brothers.

At Byron Springs, sixty-eight miles from San Francisco, in Contra Costa County, Cal., the springs all contain with the other minerals a large amount of "sodium chloride," which being translated means common salt, in one case an amount that is inconceivable. Intensely salty fails to convey the idea. In one spring the water contains 15,417 grains, or 33 per cent. Salt Lake, the most heavily charged water on this continent, contains only 11,000 grains of solids to the gallon. The Dead Sea, of Palestine, which comes next to the Byron Springs, falls more than 5,000 grains behind, having 13,488 grains to a gallon. No one can imagine the taste of such water, which really does not convey an idea of salt. Other minerals disguise the salt. The same water contains calcium chloride 2,364 grains, and of magnesium chloride 622 grains, and about a dozen more minerals with Latin names, but in such small quantities as to be disregarded.

The construction of "original" matter in the various journals of this Coast is an ingenious process. Being here at one end of the continent it is the proper province and privilege to collect and collate matter from the Eastern journals, but the manner of it is amusing. The scissors are the principal implement, something is cut out and pasted in without credit, and the next journal credits to the scissors man, so the matter is born again, and belongs to the preëmptor. It is cheap, easy and dishonest. If one has nothing to add that requires rewriting such matter, there is yet the obligation of reducing five or six pages to one, and giving the same information, thus modifying the usual dishonesty of taking without credit. Extracted matter should not only be credited, but notice given "at the top," a custom always followed in "INDUSTRY."

Two of our exchanges come from India; one, *The Textile Journal* of Bombay, noticed some time ago as one of the best made up that is published anywhere in the world; the other the *Harbinger*, published at Lahore, is unique to our conception. It is Hindu, in every way representing the peculiar line of speculative thought that characterizes a people who for unknown ages have blended their practical and religious life. Ideas that seem absurd at first thought, because differing from our own, when tested by rules of logic and common sense, become true and beautiful. Among other things each number contains a selected translation from the Veda, or Rig Veda, the sanscrit character being given, the mother of Greek, Hebrew and of all human tongues. The *Harbinger* is devoted to monotheism, vegetarianism, scientific study, commerce, manufactures, agriculture and other subjects, all of which are treated in a novel and interesting manner.

The general "looseness" of things public is indicated by a letter lying at hand, dated May 12th, at Calistoga, Cal. On the cover is stamped "Calistoga, May 13, 3 P. M." In another stamp "San Francisco, May 13th, 10:30 A. M.," so the letter must have arrived four hours and a half before it was posted at Calistoga. This letter was then forwarded to Sausalito, where, by its mark, it was received on May 12th, or one day before it was mailed in Calistoga. We have known of expediting the mails by the Dorsey Star Route method, but not of celerity of this kind, which shows an exceptional mail service that outruns the calendar twenty-seven hours in going seventy-eight miles.

The H. N. Cook Belting Company, of this City, have devised and patented machinery for stretching leather on a new system, that may be called a "differential" one, or perhaps a logical one. Heretofore the stretching clamps have been moved positively, so as to stretch a side uniformly, or irrespective of its elasticity or yielding quality, but with this new machinery the clamps are jointed, and in a sense are pivoted, that is can be moved independently at each end and in the middle, so the back and flank of the side of leather can be stretched independently, or a whole hide can be stretched on different lines, so the effect is uniform. In this manner belt sections cut from any part will retain their shape. Stretching leather does seem to be an intricate process, but there are a good

many ways of doing it, and with widely varying effect. The machine named seems to embody all the required features of perfect work.

The streets of this City in the trade districts furnish ample, and in some respects objectionable, evidence of a great increase in business. The merchants have moved out on the sidewalks for the summer. The lack of hollow squares, or even rear streets, is being severely felt as the volume of trade increases. The most marked among signs of returning prosperity is the increase in wages made by a number of the large manufacturing companies in the Eastern States, and most remarkable among such cases is that of the Carnegie Company, at Pittsburgh, where a raise of 10 per cent. has been made. On this Coast we always follow last in business changes, naturally so at both the beginning and the end. There is also the fortunate difference of less "intensity" here. We make quite as much complaint because less prepared for hard "times." Frugality is not popular on this Coast, and will not be we fear, for many a decade to come.

COMMENTS.

Canada, like our own country, is suffering from "parasites." The *Canadian Engineer* thus denounces the spoils system:

"The human maggots who are fattening upon our cities as upon a carcase, are developing a mass of corruption that is tainting the common air of all business, and the stench thereof will before long wake up the people to the danger of their surroundings. Retribution is already at hand in the case of Montreal, for the people after permitting all these years the plundering of their own treasury, and the disgrace of their good name, now find hundreds of fellow citizens out of work, and themselves face to face with increased taxation, or still worse, more public borrowing. With the money that has been squandered and stolen plenty of useful work could have been provided for the present unemployed. They may now see the kind of carrion birds they have invited to their nest. No city in Canada has been more bountifully assisted by nature and circumstances than Montreal. It remains for her citizens to see what they will do to destroy or restore its position. The same alternative is before many other leading cities and towns of Canada. They must either purify their civic politics or sink to disrepute."

According to a responsible contemporary, a gang of Italian laborers working at Jersey City for the Lehigh Valley Railway are housed like cattle in a dilapidated old barn. They dig holes in the ground, and build fires in the holes for cooking, this operation relating to roasting minnows caught in a canal alongside. The importation of such men is a crime, but the very people who import and employ them are the boisterous "champions of American labor," who feel a great concern about the reduction of wages. These poor ignorant immigrants would never come here from Italy, Hungary and China unless encouraged to do so. The simple fact is that by the pressure of stagnant trade, and the struggle to exist, men lose all regard for others, and become rogues. The demoralizing effect of hard times is never treated upon, but it is perhaps of all, the greatest cause of vice and crime.

The Westinghouse Machine Co., of Pittsburgh, Pa., makers of the Westinghouse engines, are building for themselves a new habitation on an extended scale. The new works, in which the main building will be 602 × 230 feet, is situated at Wilmerding, twelve miles from the city, at the same place as the other Westinghouse interests, that is the Air-Brake Co., the Union Switch and Signal Co., The Westinghouse Electric Co., and the Fuel and Gas Manufacturing Co. The buildings of the Machine Co. will cost nearly half a million dollars when finally completed, which is to be in November of this year. In this works will be seen the consummation of a scheme cf systematic manufacture, that has always been the aim of the company, impossible to attain however, except through years of evolution in any branch of constructive engineering work. One may establish an organized manufacture of some simple staple article, and proceed at once upon predetermined lines, but steam engines cannot be treated in this manner.

By an Act of Feb. 8th, 1895, the law relating to vessels "impelled wholly or in part by steam," has been amended to read "The words steam vessels shall include any vessel propelled by machinery." Leaving out the grammar of this, which no one expects in such cases, there is power in the Treasury Department to institute aggravating and useless rules that will much interfere with water traffic on this Coast. We have always contended that the navigation laws were mainly the work of the railway interest, which

is subject to no rules or inspection to secure the safety of passengers or goods, and on these grounds unfair. The development of the petroleum driven boats, of which there are some hundreds on this Coast, has grown up mainly because they have not been subject to the taxes and annoyance of steam vessels, and regulations that put these petroleum boats in the same class will to a great extent stop their building and use.

The present tendency towards inventing new laws of all kinds is not because the statutes are not extensive enough and complete enough, but it is a search after laws that cannot be violated, or to state it another way, it is an attempt to correct the evasion of laws. What is needed is not more laws or different laws, but a respect for what we have. We are marching toward anarchy as fast as possible in this contempt for law, and this little protest will as we well know not influence one man. In the late Bate refrigerator case, argued before the United States Supreme Court, the learned counsel contended for a "liberal" instead of a "literal" interpretation of the statute. There is only the difference of one letter between words, but in fact is the difference between law and no law at all. This "liberal construction" is only another name for evasion.

We have a good many times pointed out that all the talk of cheap power from Niagara or anywhere else was fallacious, and that motive power next to the precious metals would become more constant in value or price than any other commodity. It is so now, and recent negotiations by the city of Buffalo with the Niagara Falls Company show this fact. The latter-named company offer 10,000 horse power to Buffalo at $8.00 per horse power a year, or $80,000 a year for the "water alone," that is if the city will furnish the water wheels, generators and transmission, or will furnish the generating plant and supply current at $22.50 per horse power, which is the same as is charged to consumers at Niagara. The cost of transmission, the greatest of all, would no doubt raise this price to $30 a year for each horse power, and this must be near the cost of steam power there.

On the 22nd of April, the Supreme Court of the United States, declared what is known as the Medart pulley patents invalid, and thus near the end of the term, disposing of some important

inventions or improvements that have caused a great deal of controversy in this country and also in England. There was a good deal of useful invention in the pulleys, and also in the implements employed in their manufacture, and it may be claimed that the losses due to protracted litigation, both here and in England, and now to a destruction of the patents, has been the result of incapable procedure by patent agents. We speak mainly from a recollection of the British patent examined about eight years ago, which by improper draughting of the specification and untenable claims, was deemed an invalid patent there. The American decision is very long, the longest given this year in any patent case, and declares that all patents on the Medart pulleys are invalid.

The evils of trade combinations were at first unfair, then unjust, next impudent and aggressive, and now are a menace to the stability of our industries. At the present time the whole leather industry of the country, an enormous one, is convulsed and thrown into chaos by an advance of about 100 per cent. in the price of hides. Fortunes will be made by those who do not need them, and the losses will fall on the active industries. Then when the wave recedes, as it must soon, the ultimate consumer can foot the whole bill while battling with the prices for belts, boots and harness. It is a scheme subversive of honest business, and the time is approaching when people must be protected from such robbery. It is merely diffused pilfery, so widely spread, and so covered by sophistical methods, as to be called "business."

Engineering Notes.

It is nearly amusing to follow the literature of water-wheel regulation. One device after another is brought out, the last one noticed an electrical device, but no one seems to consider that all this contrivance is not directed to the true difficulty at all. A water-wheel regulating apparatus consists of two separate elements, a "governor" to indicate and set in motion the second element, the "controlling" apparatus. The latter is the main part. The "method" of control, is where we reach the real problem. Any means of throttling the water or reducing the pressure changes the speed of a wheel accordingly, but can only indirectly alter its power. If the

induction issues are reduced in a pressure turbine the efficiency at once falls off, because the wheel is not filled. Water being an inelastic fluid, there is but little analogy to steam or air apparatus, which seems to furnish nearly all the current ideas for water-wheel regulation.

There is in fact but one kind of a water wheel susceptible of economical regulation, that is an impulse or unfilled one, and but one method of regulating that, which is to change the size or number of the induction inlets or nozzles, and at the same time retain their shape and the solidity of the stream. Approximation to this is the multi-issue method, where the issues are wholly cut out or applied, and is found in the partial turbines of Girard, Rieter and others. There is much promise in a scheme recently brought to notice by the Girard Water Wheel Co., of this City, which if it answers in practice as it does in theory will settle the problem for multi-issue impulse wheels, but the complete regulation of the pressure or filled type of turbines is an "iridescent dream."

Messrs. John and Henry Gwynne, of London, can "go up head" in centrifugal pumps so far as having made the largest to this time. The old Lynden pump employed to drain the Haarlem Basin in Holland, after a faithful service of forty-six years has given way to centrifugal pumps, no doubt much to the disgust of Prof. Huett, who, as we believe, discredits these upstart machines. Messrs. Gwynne's pumps on a late trial, when the water was too scant to permit full working, raised 293 tons of water per minute to a height of 15 feet with 454 indicated horse power, computed at 65.7 efficiency, which corresponds to other like plants by the same firm and, as we think, is something less than can be attained by centrifugal pumps made on other lines or plans. The bore of the new pump is fifty-eight inches.

It is noted that the bearings of the large armatures in the Niagara Falls power plant are provided with water jackets or cooling chambers, through which cold water can be circulated about the bearings. This is a provision that costs but little, and is by far too little employed in the case of large high-speed bearings. It is usually enough to expose the bottom or fixed part of a bearing to the cooling water, and this involves only a trifling expense. In the

case of a large dynamo or motor, for example, to provide a water space beneath the bearings, connect them with a pipe or passage in the sole plate, and provide nipples for hose or pipe, would be a very useful and inexpensive detail. Such an arrangement was once provided for the bearings of a large circular saw spindle made by the Buckeye Engine Co., Salem, Ohio. This machine was constructed for a railway company in Europe, and the "water bearings" were found to be an addition of so much value that a number of other machines in the works were similarly arranged.

The Continental Iron Works, of Brooklyn, N. Y., have published a finely-executed circular or catalogue, neatly bound, and containing full information respecting the Fox and Morison corrugated boiler furnaces, of which this company are the sole makers for the United States and Canada. It is a matter of surprise to learn that more than one half the cylindrical furnaces in use now are of this type, and it would be hard to name another invention of like importance that has spread all over the world to such an extent in the same length of time. The furnaces themselves are in all of the best marine boilers on this Coast, and do not need description, but the processes of manufacture must be expensive and intricate. The Continental Iron Works were able to discern the merits of this invention and bold enough to put down the plant required for the manufacture. They are now reaping a reward in their extensive business.

Mr. W. B. Paley, in an able article written for the *Railway World*, which, by the way, is a reliable authority in railway matters, considers single engines, that is, locomotives with a single pair of driving wheels. These he claims are again coming into extended use. Ten plates are given of engines of this type as designed and in use by different European lines. The simplicity of engines of this kind is a strong point in their favor in any case where the required adhesion can be gained with one set of driving wheels. Such engines are not used in this country, but could be in certain cases with advantage. There are numerous "runs" out of New York and other large cities, from Philadelphia to Atlantic City for example, that a single engine would be less punished by high speed. The latter-named traffic is now carried on at a higher speed perhaps than exists in any other service, and the permanent way is good in

GERMAN LEARNED IN ONE MONTH. THE Rote Lexicon. Price 25c. THE INDUSTRIAL PUBLISHING CO., 40 California St., San Francisco.

every respect. Between New York and Philadelphia also it would seem that a certain part of the traffic could best be done with single wheel engines.

At a late meeting of the American Society of Mechanical Engineers, in New York, there was a discussion on the subject of gas engines that will be strange reading for mechanics and engineers on this Coast. Mr. W. L. Wildy, an English engineer, who was present, addressed the meeting on the subject of oil engines, and at the end was asked a great many questions that indicated an absence of what is common knowledge on this Coast. Think of Dr. Charles Emery asking: "Where does the oil go? Does it go first into the cylinder, or into the hot chamber?" Mr. Smith asks "what maintains the temperature of the generator?" Mr. Wildy answers "the continual combustion of oil."—Next question, "whereabouts?" If this indicates the point that the Society of Mechanical Engineers are "at" in oil engines, it would be a good thing to send some of them out to this Coast to study the subject for a time. It is not at all creditable.

It is surprising how easy it is after a great dam has collapsed, to find out the causes, and is accountable for in the fact that after a work of the kind is completed it commonly receives no more attention. The great dam in Bouzey, France, gave way last month, and "let loose" more than 7,000,000 tons of water. This water rushed down the Avriere Valley for ten miles, destroying all that lay in the way of the flood. The descent through the valley is 40 feet to a mile, so the initial force was maintained for a long distance. The dam seems in section to be a most scientific structure, but had certainly an element of flexure that disturbed its inner face, and being covered there with a thin coat of impervious mortar, *Engineering*, London, claims that the dam became pervious, permitting saturation, which by freezing or other weakening action caused it to give way. We have had a respite here in California from accidents with our many dams, which it is to be hoped will continue.

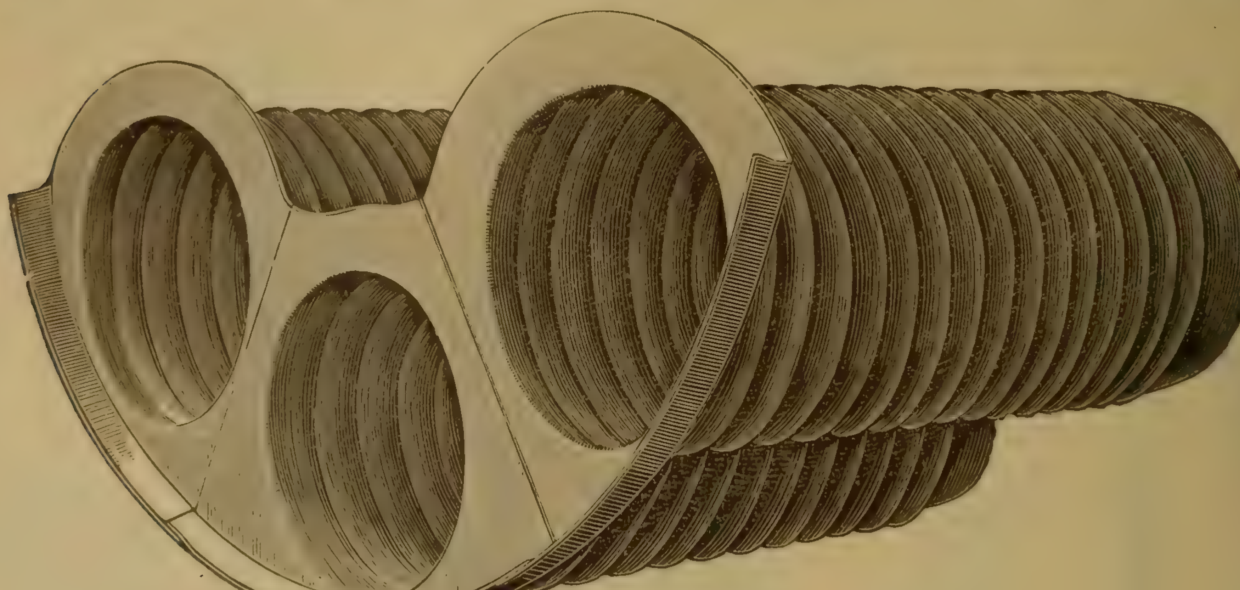
Some of the manufacturing companies in Pittsburgh are fitting up their works with narrow-guage railway lines to extend all over the grounds. The equipment is furnished by the C. W. Hunt Co.,

of New York. This arrangement is by far too seldom applied in this country. It is quite common in iron works in England, where small locomotives are employed to haul loads of several tons at a rapid rate on lines of 18 inches gauge. The separation of hoisting and conveying machinery into a branch of engineering work was a proper and fortunate scheme, taken up originally, as we believe, by the C. W. Hunt Company. Such work has no element of uniformity, and had previously to be carried out without experience or the advantage of precedent. There is a great deal of work of this kind required along this Coast in the way of loading and unloading vessels where there are no enclosed or still-water harbors. The United States Government badly needs some kind of conveying apparatus at Point Benito, and there are dozen of similar cases.

Seven years ago a locomotive on the St. Louis and Western Railway, the Cotton Belt Line, jumped off a bridge into the Red River of Arkansas, and then proceeded downward to some unknown depth in the quicksand and mud. It is not common to hunt for any thing, not buoyant, that falls into the Red River. It is charged up to the expense account, and forgotten, but in this case the superintendent, Mr. Galbraith, who is of course a Scotchman, did not like the entry of "drowned" in the record of the engines, and after seven years, at a time when the water was low, began to dig out the engine, found it, and with strong tackle, pontoons and persistence hauled the engine out, sent it to the shop, and in seven days had it in service again good as new. It is no doubt the only engine in the world with such a romantic history. An account of the matter with illustrations will be found in the *Railway World* for May, 1895.

We much regret the want of space to publish, in part at least, the late discussion in the British Parliament, respecting the water-tube boilers that are to be fitted in the battle ships *Powerful* and *Terrible*, and in other vessels. Making due allowance for conservatism and the advantage of an occupied field, the opponents of the water-tube system had certainly the advantage throughout, even on the grounds of statistics and facts. The truth of the matter seems to be that the famous engineering firm of Maudsley Sons and Field, became agents or licensees and makers of the Belville French type of water-tube boilers, and urged their

CORRUGATED FURNACES



FOR

MARINE and LAND BOILERS

ALSO

MORISON SUSPENSION FURNACES

SOLE MANUFACTURERS IN THE UNITED STATES

THE CONTINENTAL IRON WORKS

BROOKLYN, NEW YORK

THOS. F. ROWLAND, President
THOS. F. ROWLAND, Jr., Treasurer

WARREN E. HILL, }
CHAS. H. CORBETT, } Vice-Presidents

Take East 10th or 23d Street Ferries from New York to Greenpoint.

INCORPORATED 1866

Insures against Damage to Property, Loss of Life, and Personal Injury

CAUSED BY

STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

CHARTER PERPETUAL

J. B. PIERCE, Secretary

J. M. ALLEN, President

ABSTRACT OF STATEMENT
JAN. 1, 1895

Cash Capital,	**$500,000.00**
Total Assets,	**1,955,255.24**
Surplus as to Policy-Holders,	**693,726.15**

PACIFIC COAST DEPARTMENT

MANN & WILSON, General Agents

J. B. WARNER, Chief Inspector

306 Sansome Street, - San Francisco, Cal.

adoption a little too strenuously upon Lord George Hamilton with other Admiralty officers, and secured the adoption of such boilers before the engineering opinion of the country was ready for such a change, and certainly in advance of precedents, as could reasonably be expected in such cases. The record for room, endurance and efficiency, is yet it seems in favor of the shell boilers.

Messrs. French and Linforth, of this City, are furnishing an oiling cup, that operates by some obscure method not easy to explain. There is a simple bent wire shaped like a siphon, one end resting on the shaft and the other end immersed in the oil. When the shaft or bearing is in motion, the oil crawls up over the loop on the surface of the wire and runs on the bearing; when the bearings stop the oil stops also. The vibration or jar caused by the point of the wire rubbing on the shaft seems to be the inciting cause of the flow over the surface of the wire. This is evidently a "discovery," because no one would by inference expect oil to act in that way. The device is called the "Finch oil cup," and is used by a large number of the works here in the City and elsewhere on the Coast, as many as 400 being used by one company.

There is a difficulty in respect to the cooling jackets around the cylinders and other heated parts of gas engines, not apprehended by many, that of incrustation. The ordinary temperature of the cooling water is not high enough to cause a deposition of the contained salts, such as magnesia, carbonate of lime and so on, but when an engine is stopped or when circulation of the water ceases, the temperature of that contained in the jacket will rise to the critical point and deposition takes place. A short time suffices to fill the narrow water spaces. Such a thing will not of course happen when the water circulation is by gravity, or other means than by a pump operated by the main engine, but it is a good thing to know, especially in the lime districts of the Middle States, where a common tea-kettle needs frequent scaling.

In a late article on "gear teeth," found in a contemporary, the writer, Mr. Samuel Weber, says, diametrical pitch came into use since his working days, and "conveys no meaning to his comprehension."

As diametrical pitch was employed in Bodmer's works in 1842, and previously, Mr. Weber must have quit the works early in life, and his comprehension must have left even sooner. He goes on with his article without discussing the problem of diametrical pitch however, so one is at a loss to know what it has to do with the strength of what he calls the teeth of "gears," meaning thereby gear wheels, and winds up by saying in respect to some wheels made, that he does not know how he could have got the dimensions for the wheels from a table of diametrical pitch. One reason for noticing this article, is that here is a mechanic with undoubtedly a good deal of experience, that does not know what diametrical pitch means, and that it need have nothing to do with the dimensions and strength of wheel teeth within any limit that need be considered.

The pitch sought for or derived in the case above noted, was 4⅛ inches, and each tooth represented 1.313 inches in the wheel's diameter, and must have brought out some queer dimension in that direction. In the computation for the thickness of teeth, the rules employed gave from 1.89 to 2.05 inches. There were certainly points between, that with inconsiderable variation would have given a diameter in even inches, instead of some absurd fraction, which as the number of teeth are not given, does not appear. Such a wheel is not likely to have less than 30 teeth, and with this number the diameter of the wheel would be 39.398 inches, if any one can find out what that is. Suppose the same wheel would have been made 40 inches diameter, then the pitch instead of 4.125 inches, would have been 4.141 inches, or .016 more, a difference that would have a dozen places between the different pitches or rules named by the writer. The wheel when done would have matched all others of ¾ diametrical pitch, which this is. The pattern would have been a standard one, and all contingent dimensions computable and convenient.

Mr. C. A. Parsons, of Newcastle, England, maker of the impulse engines or steam turbines of which we had mention in several places last month, sold 4,000 horse power of these engines in March, and consequently for three months of this year 12,000 horse power, which exceeds any engine business that has ever existed before. He now has to call in the aid of other firms to assist in filling his orders. Those who will refer to No. 2, of

"INDUSTRY," published in 1888, will find a tolerably good prophecy there of this development of the steam turbine. Not only then, but almost constantly since, we have urged attention to this new form of steam engines, but this far without much effect on this Coast. Even facts do not seem to do much good, and contrary to the usual custom in such matters we are waiting for the Eastern makers to supply impulse engines.

Among the schemes, fanciful and real, in water power and electric transmission, comes one from Baltimore, or with that city as an objective point. The proposition is to dam the Susquehanna River at Conowingo, in Maryland, where the fall and volume of water will yield 25,000 horse power, and as this point is within transmission range of an endless market there is a strong probability of the project being carried out. There is, we imagine, in this, as in nearly all other cases, a neglect of the low-water limit. Perhaps no great river on this continent fed from the mountain sources has at its source a more constant volume from year to year than the Susquehanna, and none east of the Rocky Mountains that loses so much by evaporation. If it had a bed like the Rio Grande, Platte, or Colorado Rivers, the waters would disappear before they reached the Chesapeake Bay. It is spread out like a thin sheet to an enormous width, but flows over a rock bed and loses by evaporation only.

ELECTRICITY.

Mr. Irving Hale has given the following explanation of the three-phase system now being employed by the General Electric Company in transmission:

"This system may be best described as a combination of three alternating currents out of step with each other. That is, the alternations occur at different instants, one third of a 'cycle' or complete alternation apart, so that when one current is at zero, or changing direction, the other two are not. The result is a steady torque or pull, somewhat similar to the direct current. The motor usually employed in this system is self-starting, with or without load, and capable of speed regulation. In fact it has all of the good qualities of the direct-current motor, and is superior to it in having no commutator, brushes or sliding contacts of any kind, the wires supplying the motors being attached to the field coils and the current, and the armature or revolving part being an 'induced' current, and

the armature having, therefore, no connection whatever with the external circuit. While thus equaling, and even excelling, the direct-current system in these respects, the three-phase system being alternating in its nature permits the use of high voltage, and consequently the transmission of power over long distances at moderate expense."

The Electric Traction Co., of Philadelphia, have a knife switch of 7,000 amperes capacity, to break a current of 4,700 horse power, employed on their street railway circuits. The bars of copper, six in number, are 5 × ¼ inches, having an aggregate section of 7½ inches, but the whole is so compact as to occupy but 13 × 14 inches on the switch board. The handle or lever, is however, more than 40 inches long. The puzzle is to know what takes place when a circuit of this power is opened. It is done of course, otherwise the switch would not be required. The energy controlled can be likened to a steam pipe and valve of 18 inches bore. Electricity is a wonderful thing, and causes a mental strain to the uninitiated, also makes one nervous to think of these giant forces "lying around loose," and rendered active by merely "stirring up," so to speak.

The Thomson-Houston Co., of England, have made arrangements with the Elswick Works, Sir William Armstrong, Mitchell & Co., at New Castle, for the construction of their electrical machinery and plants. This indicates the difficulty that the directors of the great iron works have in keeping their works filled with orders, not that the work is of an undesirable kind, but it is quite a departure from guns, ships and hydraulics. The Union Iron Works here, is a similar case. They are adding electric machinery to their product, and there is this to be said, both of New Castle and San Francisco, that for two years past it has been great folly to add new machine works or to extend those we have. Progress in implements and processes is necessary, but can be applied as well in an old as in a new works, and at much less expense. Mr. I. M. Scott thinks there has been a shrinkage here of twenty-five per cent. in machine-making capacity, and it is perhaps not wholly a misfortune.

Mr. H. H. Preece, the celebrated English electrical engineer, by a complete experiment made some months ago, established the possibility of useful telegraphing by induction. A wire was laid

along the mainland shore opposite a parallel line on the Island of Mull, on the west coast of Scotland, and messages were sent across without connecting wires. In an account of the matter in foreign journals, the distance is not given. Other experiments of the same kind have been made in Scotland, in one case across Lake Ness. This, as our readers will remember, has been a study with Mr. Edison, who will, no doubt, if there are useful possibilities in such a system, take it up again and carry it to a successful conclusion. The range and possibilities of induction at a distance is comparatively an unexplored field.

We were puzzled for a time recently in looking over the drawings of an electric generating plant, erected for the Midland Railway Co., in England. The engines were short coupled, but on further observation it turned out they were "gas engines," four of them 40 horse power, and two smaller ones. The plant is laid down in every respect like one for steam engines. The engines were made by Messrs. Crossley Bros., of Manchester, on the Otto system, and have no new features we can discover except porcelain igniting tubes, which it is claimed are "indestructible." If this is true it is time that the makers here were looking into the matter. Messrs. Crossley Bros. are among the oldest and best makers in the world, beginning under the Otto patents, at least twenty-five years ago. They have gone over the whole field, the Otto slide, electric spark, and metallic tubes for igniting. The adoption of porcelain tubes is a significant circumstance, so is a regular plant of gas engines for a generating station of the highest class.

The annual report of the General Electric Company, to Jan. 1st, 1895, has been printed and sent out, and shows a better state of the business than was expected after the reports circulated in the Autumn of 1894. The gross earnings were $13,236,611, and operating expenses, which it seems includes material and labor, were $11,451,864; net profits $1,811,747. The depreciation is $933,521, and surplus $413,643. The dividends declared on preferred stock were 7 per cent, and on common stock 3.44 per cent. These enormous operations are conducted with much the same risks as a small business, that is, are equally affected by dull times, and burdened with a fixed expense account that is fearful to contemplate. We believe that the past year has been the most critical one this and other great companies will be called upon to pass through.

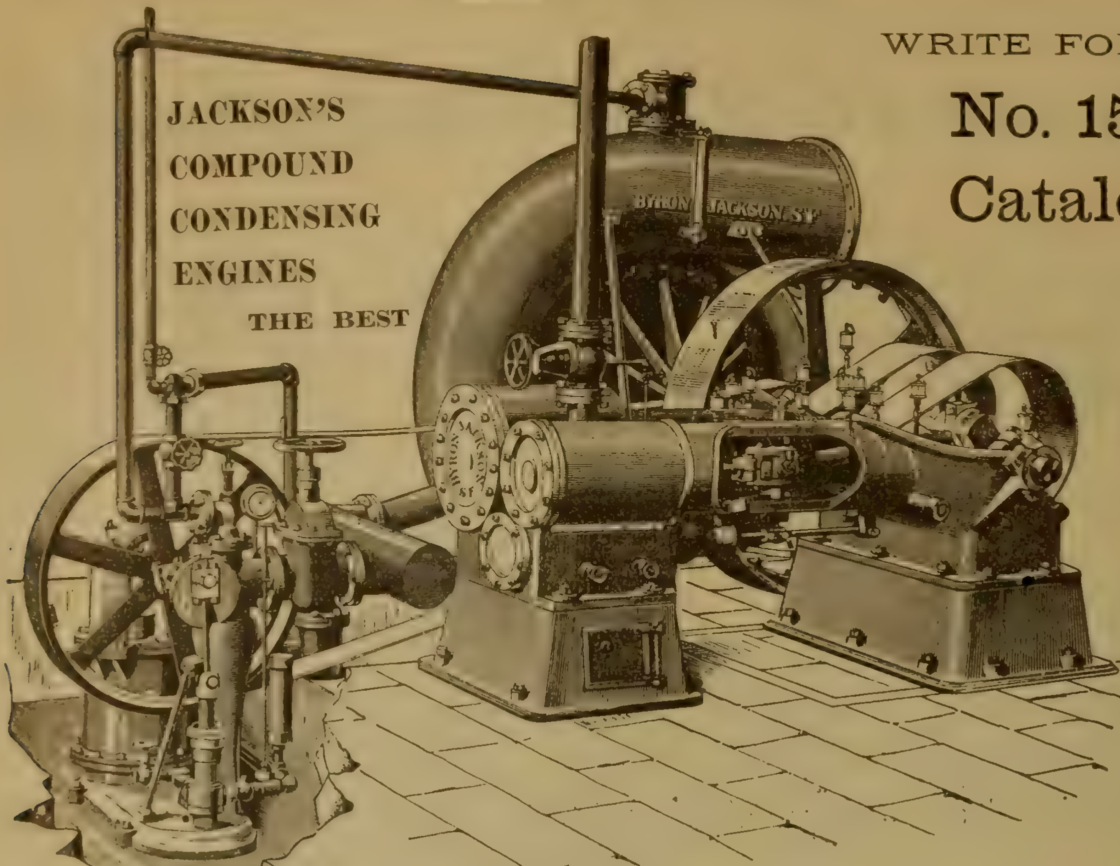
MINING.

NOTES.

Mr. Chesebrough, proprietor of the Magnolia Hotel in Calistoga, has in his place hot sulphur baths, the water rising to the surface at a temperature quite warm enough for bathing. To extend this department he excavated in the rear of the hotel for a swimming pool, and in doing so came upon deposits of cinnabar to such an extent, and of such a nature, as to cause the recording of mineral claims on contiguous land. The other side of St. Helena, as is well known, contains the principal quicksilver mines of California, and there is nothing strange in finding this mineral in the principal valley on the south side; besides the Calistoga district, which already has some mines at work, has many of the natural conditions that accompany mineral deposits. No one is more worthy to prosper by the discovery of quicksilver than Mr. Chesebrough, and all will wish him success.

If there was a tenth as much technical as there is business news from the mining regions, this department of "INDUSTRY" would be full to overflowing, but as the business news just now is the most important, or at least of most interest, we find ourselves quite "out of circuit" in mining notes. The fact is, that during a long period of inaction in the mines, mining men turned their attention to the improvement of processes, and are just now applying them. Mining men who come to this City, and there are many of them now, do not ask what is "new," but what is the price? The best feature of all however is the number of old mines being reopened, especially in the foot-hill country of California, and there are those who predict that the burnt-out shafts in the Amador district will all be pumped out and retimbered. Low grade ore that once was a "bug bear," is no longer so, in fact has become in a sense a preferance, because quality is apt to be inverse as quantity.

In some recent figures respecting copper production in this country, it seems that with much the same kind of ore since 1864, but otained at much greater depths, the cost per pound of producing copper has fallen from 26.71 cents in 1864 to 5.68 cents in 1894. This decline has gone on gradually, and in a very constant proportion for thirty years. The out-put by the wonderful improvements in



WRITE FOR

No. 15 Catalogue.

JACKSON PUMPING PLANT FOR IRRIGATING AND RECLAIMING LAND.

Byron Jackson Machine Works

625-631 SIXTH ST., SAN FRANCISCO. CAL.

BUILDERS OF

COMPOUND CONDENSING ENGINES

AIR PUMPS AND JET CONDENSERS.

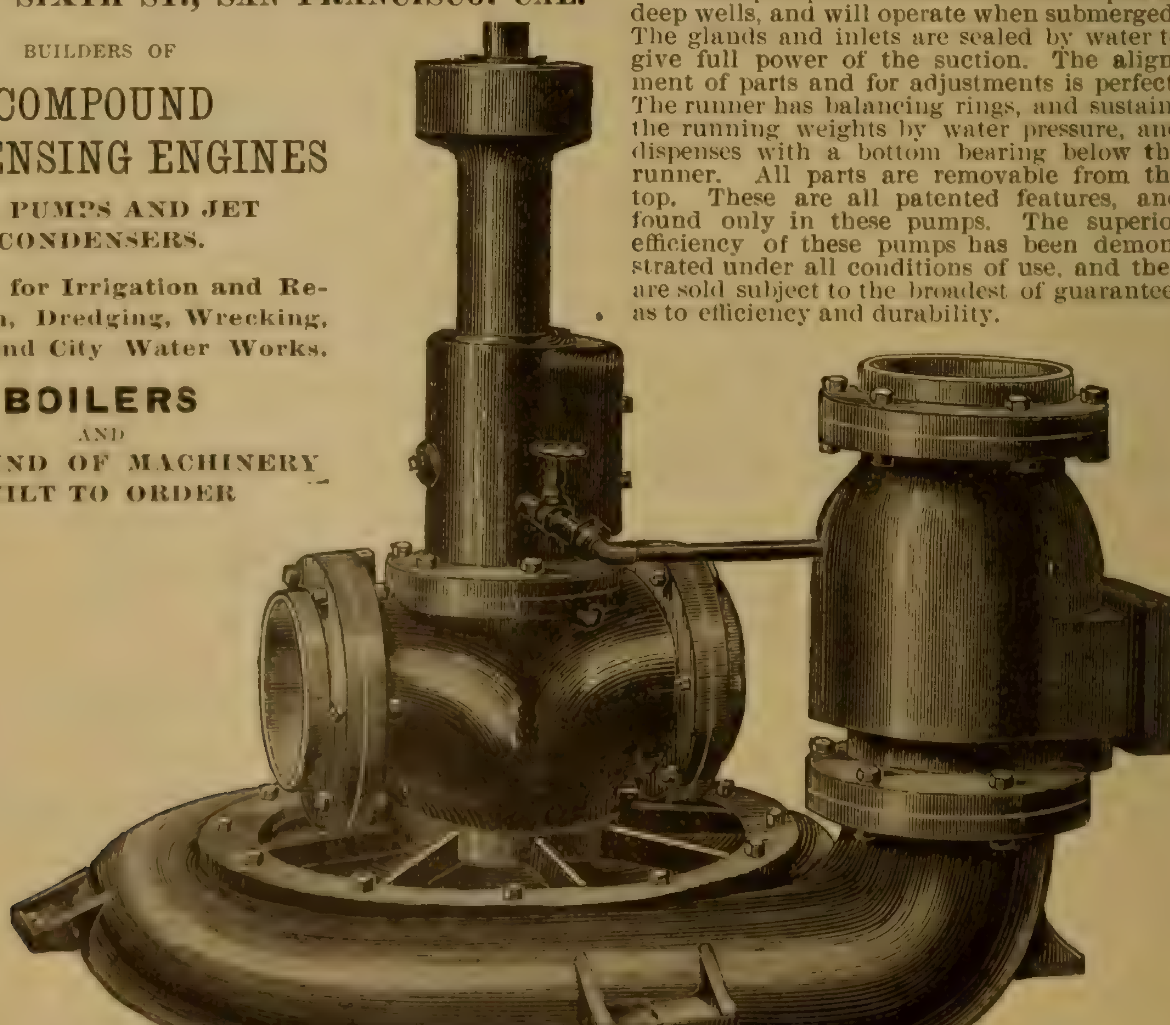
Pumps for Irrigation and Reclamation, Dredging, Wrecking, Mining, and City Water Works.

BOILERS

AND

ANY KIND OF MACHINERY BUILT TO ORDER

These pumps are intended for mine pits or deep wells, and will operate when submerged. The glands and inlets are sealed by water to give full power of the suction. The alignment of parts and for adjustments is perfect. The runner has balancing rings, and sustains the running weights by water pressure, and dispenses with a bottom bearing below the runner. All parts are removable from the top. These are all patented features, and found only in these pumps. The superior efficiency of these pumps has been demonstrated under all conditions of use, and they are sold subject to the broadest of guarantees as to efficiency and durability.



Jackson's Vertical Water-Balanced Runner and Shaft "Whirlpool" Centrifugal Pump.

powder, implements, machinery and methods have wrought this change, and the question arises if this has been the history of copper, why has not a similar change taken place in silver, an affiliated metal, found associated in most mines? No one will argue, or at least no one has argued, that the decline in the price of copper is an appreciation of gold. The fact is the analogy is complete, and the causes are the same for the decline in the price of copper and silver. It costs less to procure them, and that is the measure of their value.

Miscellaneous Notes.

A little statistics is a dangerous thing. Last month we commented on the decline in the price of farm products, mentioning a few, but when the nine principal ones of barley, corn, cotton, hemp, oats, meats, rye, tobacco and wheat are taken together the decline in price is but 1.6 per cent. from 1860 to 1891. Some years ago, as in 1875, there was an inflation to 1.16 per cent. over 1860, but on the whole a tolerably stable price, sinking lowest in 1885 to 87.9. Statistics for the last four years are not given in the report of Mr. Upton, of the United States Senate Committee on "Prices and Wages," but as we all know the decline must have been, since 1891, 25 per cent. or so, but not 50 per cent. as we supposed or said. In Europe similar changes have occurred, naturally of course, the market being much the same for the commodities named.

The surveying corps that are determining the boundary line between the United States and Mexico, from El Paso, Texas, to San Diego, experience what may be called "tough times." This line passes through the extreme arid region for more than 700 miles now completed. Water costs twenty-five cents a gallon in some places. A man requires nine quarts a day, and each mule twenty gallons. When thirst comes on, delirium soon follows; the blood becomes thick and circulation ceases. Sand storms are another danger, causing suffocation. The surveying party had an escape from one of these by covering their mouths with cloth, so as to strain out the dust. The strangest thing of all, if correctly described, are the giant cacti that grow on these deserts without deep roots. They are half water, and where it comes from is a mystery; there is none in

the air, and none in the ground at a hundred feet of depth. This survey began in 1892, and will not be completed for a long time to come.

"Sweden's common bread," says the *American Miller*, "is a rye cake with a hole in the middle. These are baked twice a year, and then hung up to dry. They are said to be nourishing, but are about as easy to chew as a disc of mortar." The *Miller* has evidently not been in Sweden. If he had he would know that the *cuisine* is quite up to the standard of any European country, even France, where the Swedish customs to a great extent come from. The *hort bröd*, above referred to, is common, universal one may say, and ought to be, but is not as is here intimated eaten because inferior. If the *Miller* will order a barrel of it, as we have done, the invoice will cause astonishment. It is not cheap at all, but is a dear kind of bread. Its use is learned by habit, and one never tires of it. It is made of different grades of flour, some of it nearly white for fine places, but the dark colored is best. The cakes are about ten inches in diameter, an eighth of an inch thick, and are broken up when served.

The most humorous thing met with in a long time, is an account in the *American Machinist*, by Mr. William H. Harrison, of a visit to a French flagship. To understand fully the fun of the matter one should have some acquaintance with French practice of the mechanic arts, which besides differing from the same work here, or in England, is also in many cases awkward and inferior. No one can excel in all things, and while there is no denying that the foremost place in many of the civilized arts must be yielded to the French, machine work is not among these. Mr. Harrison evidently writes with some prejudice, a good deal indeed, but one has to laugh at some of his comparisons. The *indicateur Richards; pompe alimentaire*, (feed pump), and the *pompe de petit cheval*, (pump of the little horse), are ludicrous adaptations from English terms. The serious criticisms, among which he forgets the lack of a system of screw threads, are fully warranted. A French machine we saw on this Coast, a grinding mill requiring about ten horse power to be transmitted from a pulley 4 inches in diameter, fluted with "fine grooves so the belt would not slip."